OCTOBER, 1923

ROADMASTERS' CONVENTION NUMBER

Railway Engineering and Maintenance

The Joint as Strong as the Rail

By our process of manufacture, we successfully overcome many difficulties quite common with the ordinary step or compromise joint. We can furnish a joint for practically any combination of tee rails, and can allow for wear on the worn rail heads when specified. This guarantees the best possible fit.

Q. & C. Rolled Steel Step Joints practically overcome low joints. They support the ends of the rail firmly and provide the lowest maintenance cost. Specify them in your requirements.

THE Q & C CO.

RAILWAY EXCHANGE BLDG., ST. LOUIS.

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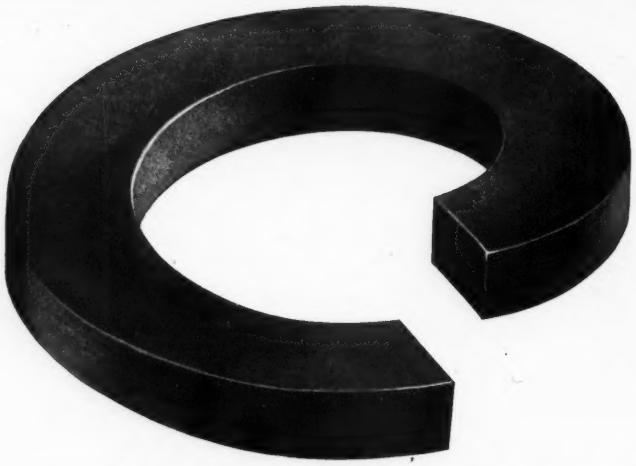

AMONG THE ADVANTAGES OFFERED by the Convention, is the opportunity of personally investigating the service performance possibilities of Hy-Crome Nut Locks, and of becoming more closely acquainted with the aims and ideals of their makers. You can not fail to be intensely interested in the remarkable results shown by Hy-Crome in tests so convincing that no room is left for doubt. We are looking forward with keen pleasure to the beginning of many new friendships, as well as the renewing of old ones, at our Booth No. Twenty-three.

THE RELIANCE MFG. CO. · Massillon, Ohio

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RELIANCE HY-CROME NUT LOCKS

Keep Tight Joints TIGHT

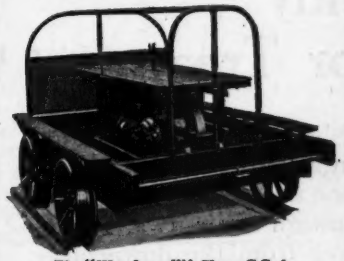
RAILWAY ENGINEERING AND MAINTENANCE
Entered as second-class matter June 23, 1916, at the post office at Chicago, Ill., under the Act of March 3, 1879. Published Monthly by Simmons-Boardman Publishing Company at 608 S. Dearborn St., Chicago. Subscription price, United States, Canada and Mexico, $2.00 a year; foreign countries, $3.00 a year.

Alphabetical Index to Advertisements, Page 54 Classified Index to Advertisers, Pages 52 and 54

A COMPLETE LINE of WATER-COOLED and AIR-COOLED MOTOR CARS

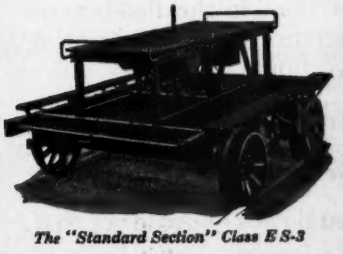
The "Special" Class E-11

The "Safety First" Class E-6



The "Wonderpull" Class G S-4

The "All-Service" Class W S-1



The "Standard Section" Class E S-3

Mudge Cars Fulfill All Requirements

Whatever your conditions—there is a Mudge for the job.

Six distinct models are available — side drive and center load inspection cars, free running or direct connected section, bridge and extra gang cars, either air-cooled or water-cooled.

The line is complete, for all service from 1 to 50 men.

Whatever your requirements, you can select a Mudge Car with absolute assurance that it will economically fit your conditions of service.

Catalog on request

Mudge & Company

Manufacturers—Railroad Equipment
Railway Exchange Bldg. • CHICAGO

The upward movement of the water in a conical bottom treating tank of the proper design must follow the bottom of the tank closely regardless of temperature and all space within the tank is constantly available for treatment and reaction; therefore in making a comparison of the cost of flat bottom and conical bottom tanks for treating water an allowance should be made for a larger tank of the flat bottom type to allow for variations in temperature. These features together with the additional cost of an efficient sludge system were given consideration in designing the Illinois Central plants and the difference in first cost was found to be in favor of the conical bottom tank.

The conical bottom tank for water softening in the rate over the flat bottom tank also has a decided advantage of upflow. For example: a 30,000 gal. per hour treating plant will require a tank of 150,000 gal. capacity (based upon Illinois Central practice which provides five hours reaction and settling time). Assuming a height of 50 ft. for the softening tank a flat bottom tank of the desired capacity will have a diameter of 22 ft. 6 in. and a rate of upflow of 8 ft. 4 in. per hour. A conical bottom tank will have a diameter of 28 ft. 8 in. or a rate of upflow of 5 ft. 4 in. per hour. If the reaction time is only four hours, which is common practice, the rate of upflow in a flat bottom tank is over 12 ft. per hour while the rate in a conical bottom is less than 8 ft.

— Ry. Eng. & Maintenance for Aug.

First in Water Softening

The HORTON Conical-bottom Tank

All Space Is Constantly Available for Treatment

The HORTON Conical-bottom tank is designed so that the water, in its upward movement, closely follows the bottom of the tank. In the flat-bottom tank the water moves upward and outward at an angle of 46 to 60 degrees from the downcomer, leaving a dead water space holding 5,700 gallons in a tank with a radius of fourteen and one-third feet. A flat-bottom tank enough larger to have the same amount of water available for treatment as the conical-bottom tank would be more expensive than the latter.

Illustrating Dead Space In Flat Bottom Tanks

Another decided advantage of the Horton Conical-bottom is that it allows more time for sludge settling and softening reaction. The rate of upflow is 50 per cent less than in the flat-bottom tank—an important difference where the treating time is only four or five hours.

We believe this tank will come into general use with softening systems just as it has become a standard for roadside delivery.

Write for quotations—you do not obligate yourself.

CHICAGO BRIDGE & IRON WORKS

CHICAGO 2452 Transportation Bldg. | DALLAS 1646 Praetorian Bldg. | SAN FRANCISCO 1007 Rialto Bldg. | NEW YORK 3156 Hudson Terminal Bldg. | ATLANTA 1036 Healey Bldg.

326

On the Burlington near Ashburn, Mo.

Railway Engineering and Maintenance

Formerly the Railway Maintenance Engineer

Vol. 19 October, 1923 Number 10

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WOULD YOU LIKE TO KNOW

If salt will protect timber from decay?

If there is any cure for the transverse fissure?

How to teach trackmen to guard against injuries?

How to get river water to pumps where the stage varies greatly?

How to curtail work train service?

Answers to these and other practical questions will be found elsewhere in this issue.

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Subscription price in the United States, Canada and Mexico $2.00 per year; foreign countries $3.00. Single copies, 35 cents. Foreign subscriptions may be paid through our London office (34, Victoria Street, S. W. 1) in £-s-d.

Railway Engineering and Maintenance is a member of the Associated Business Papers (A. B. P.) and of the Audit Bureau of Circulation (A. B. C.)

International

A Great Opportunity

IT is a recognized fact that sound treated ties have a life in track of two to several times that of untreated ties, which means an annual saving of 10 or more cents per tie per year. This yearly economy increases as more treated ties are put in service, by reason of longer tie life, fewer renewals, a reduction in tie requirements and fewer track disturbances.

It goes without saying that railroads desire sound ties, well seasoned and thoroughly treated, to bring about such economies; but, where are you going to get them when you need them?

During the past season when the demand for ties was big—lax grading characterized tie inspections—anything went as a tie—very little inspection—and as one man said at the last Tie Producers' Convention in New Orleans, "The arrival of a wagon load of ties is the occasion of an auction"—bidding prices up and no inspections.

You cannot get full value using such haphazard methods of buying. There's no reason why you should waive any restrictions in order to get ties. The International organization will ship you sound, standard A. R. E. A. Specification Ties with absolutely no substitution of grades—you get full value for your tie dollar.

International Creosoting &

General Office— Galv

PLANTS:
Texarkana, Texas

TREATED TIES

To Save Money

THE International organization has taken an important step in the tie field—a step which denotes progress and promotes integrity. By inserting an I. C. & C. Co. dating nail in all ties which leave its plants, the name International is connected with those ties during their entire life. Thus they are permanently marked to represent International treated tie quality, which means the production of only sound high grade ties of full size in accordance with A. R. E. A. specifications, carefully graded, thoroughly seasoned, and effectively treated.

In this manner the International stakes its reputation and future business negotiations upon the service rendered by these ties in track.

Don't purchase "just ties." Invest in standard specification ties. It means for you better timber, more tie life, and better tie service—all of which, in the final analysis, result in lower ultimate cost.

We are now accumulating ties for 1924 use, in order to allow sufficient time for seasoning prior to treatment.

You can save time, trouble, and money by contracting now for your 1924 requirements. Our plants are advantageously located for tie concentration and storage.

Write to our main office for full particulars.

& Construction Co.

Galveston, Tex.

Beaumont, Texas
Galveston, Texas

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TEE

RAILS

OF HIGHEST UNIFORM QUALITY
ARE ROLLED FROM BASIC OPEN
HEARTH STEEL AND FROM
RE-HEATED BLOOMS

INLAND

BASIC OPEN HEARTH

STEEL PRODUCTS

TRACK ACCESSORIES

ANGLE BARS—Low Carbon, Untreated, and High Carbon, Heat Treated and Oil Quenched

TRACK BOLTS—Standard Rolled Thread, Plain or Heat Treated

TRACK SPIKES—Medium and High Carbon

TIE PLATES—Medium, Copper Alloy, and High Carbon, Hot Worked

INLAND STEEL COMPANY

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Indiana Harbor, Ind.
Chicago Heights, Ill.

Branch Offices:
Milwaukee, Wis. St. Louis, Mo.
St. Paul, Minn.

INLAND STEEL COMPANY

APPRECIATES HIGHLY THE OPPORTUNITY
IT HAS HAD DURING THE ANNUAL
CONVENTION OF THE

ROADMASTERS' AND MAINTENANCE OF WAY
ASSOCIATION OF AMERICA

TO EXHIBIT TO MEMBERS OF THAT ASSOCIATION THE FACILITIES OF ITS INDIANA HARBOR PLANT FOR THE MANUFACTURING OF

RAILS, SPLICE BARS, BOLTS, SPIKES
AND TIE PLATES

AND TO DEMONSTRATE TO THEM THROUGH ACTUAL INSPECTION OF THE PROCESSES OF MANUFACTURE THE HIGH QUALITY AND GREAT CARE EXERCISED IN THE PRODUCTION OF ALL INLAND STEEL PRODUCTS.

INLAND STEEL COMPANY
38 SO. DEARBORN STREET, CHICAGO

EXHIBITORS' SECTION

12th Annual Exhibit

of the

Track Supply Association

Held in connection with the

41st Annual Convention

of the

HOTEL SHERMAN, CHICAGO

Roadmasters' and Maintenance of Way Association of America

In the following special section are grouped pages descriptive of railway track supplies, equipment and materials exhibited at Chicago during the Convention, September 18-19-20, 1923.

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Blake Manufacturing Co. ..... Page 17
Carbic Manufacturing Co. ..... Page 16
Chipman Chemical Engineering Co., Inc. ..... Page 22
Fairbanks-Morse & Co. ..... Page 20
Fairmont Railway Motors, Inc. ..... Page 19
Hauck Manufacturing Co. ..... Page 29
Idol Track Liner Co. ..... Page 27
Ingersoll-Rand Co. ..... Page 15
Jordan Co., O. F. ..... Page 21
National Lock Washer Co. ..... Pages 12-13
Mechanical Manufacturing Co. ..... Page 28
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Reade Manufacturing Co. ..... Page 23
Selflock Nut & Bolt Co., Inc. ..... Page 25
Wharton Jr. & Co., Inc., Wm. ..... Page 24
Woolery Machine Co. ..... Page 18

Bethlehem Manganese Frogs and Crossings

The above photograph, taken after a derailment, illustrates the rugged construction of Bethlehem manganese frogs and crossings.

Note particularly that, although the force of the derailment was great enough to bend the heavy frog arm at right angles, the Mayari chrome nickel steel bolt at the throat of the frog held securely.

Every manganese frog and crossing that Bethlehem produces is equipped with Mayari Chrome Nickel Steel bolts.

Bethlehem Model 1222 Switch Stand

The illustration at the left shows the safety features of this Switch Stand.

As the arrows indicate, there is unusual clearance space between the trainman and the stand. The stand is low. Its height—only 4¼ inches above the tie—permits its installation in close quarters. The throwing lever acts in a direction parallel to the track, thus insuring the operators' safety. It is weighted for easy operation.

One of these stands was installed December 15th, 1920, at the foot of the hump at a busy Eastern classification yard. Since then it has been thrown about 600 times a day or a total of more than 590,000 times. It is still giving good service.

This design is used with all weights of rail from 60 to 150 lbs. For light rail use model 1217.

BETHLEHEM STEEL COMPANY *General Offices:* **BETHLEHEM, PA.**

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New York, Boston, Philadelphia, Baltimore, Washington, Atlanta, Pittsburgh, Cleveland, Buffalo, Cincinnati, Detroit, Chicago, St. Louis, San Francisco

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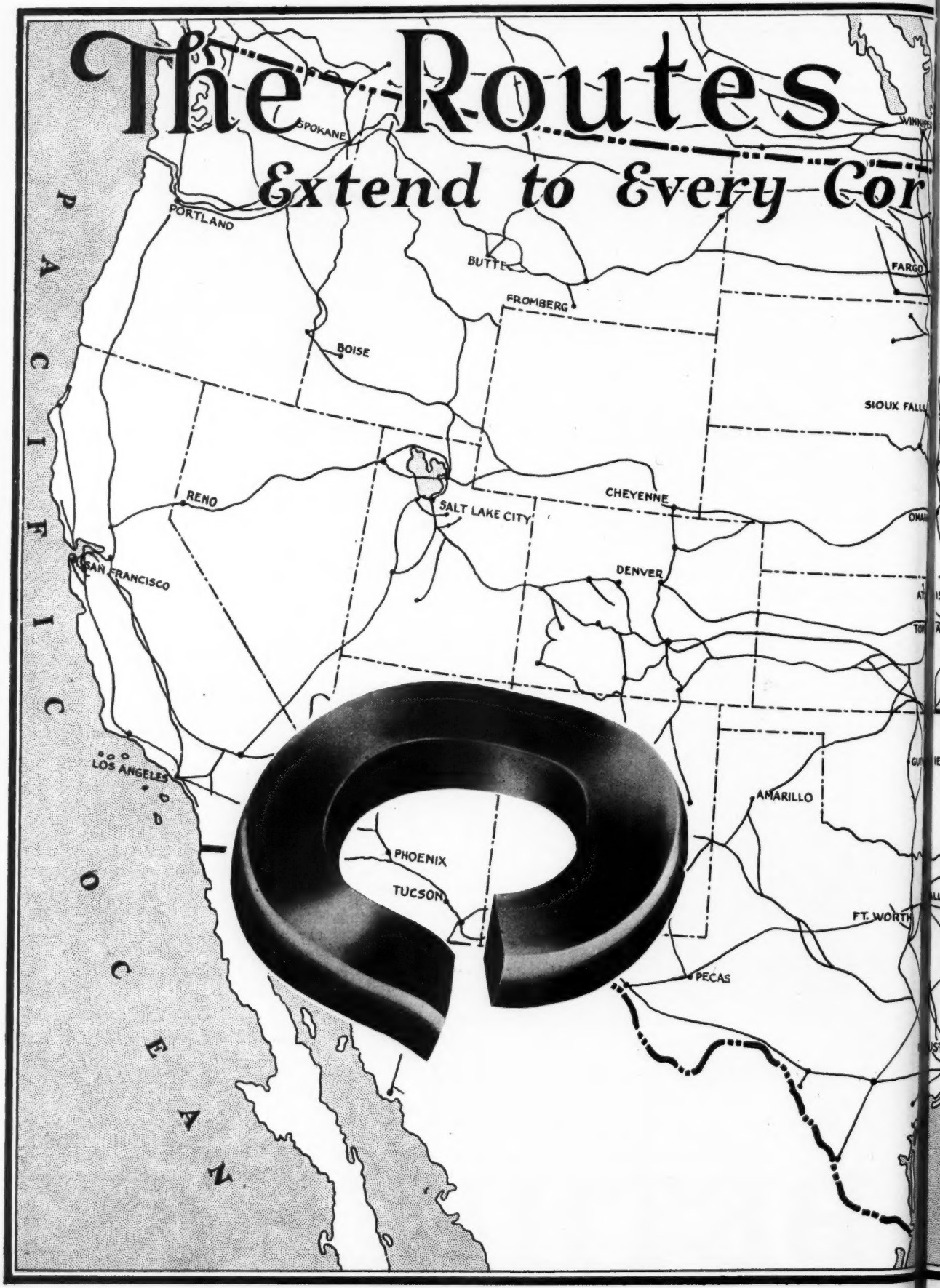
BETHLEHEM


The Routes
Extend to Every Cor
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PORTLAND
BUTTE
FROMBERG
BOISE
FARGO
SIOUX FALLS
RENO
SALT LAKE CITY
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DENVER
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PHOENIX
TUCSON
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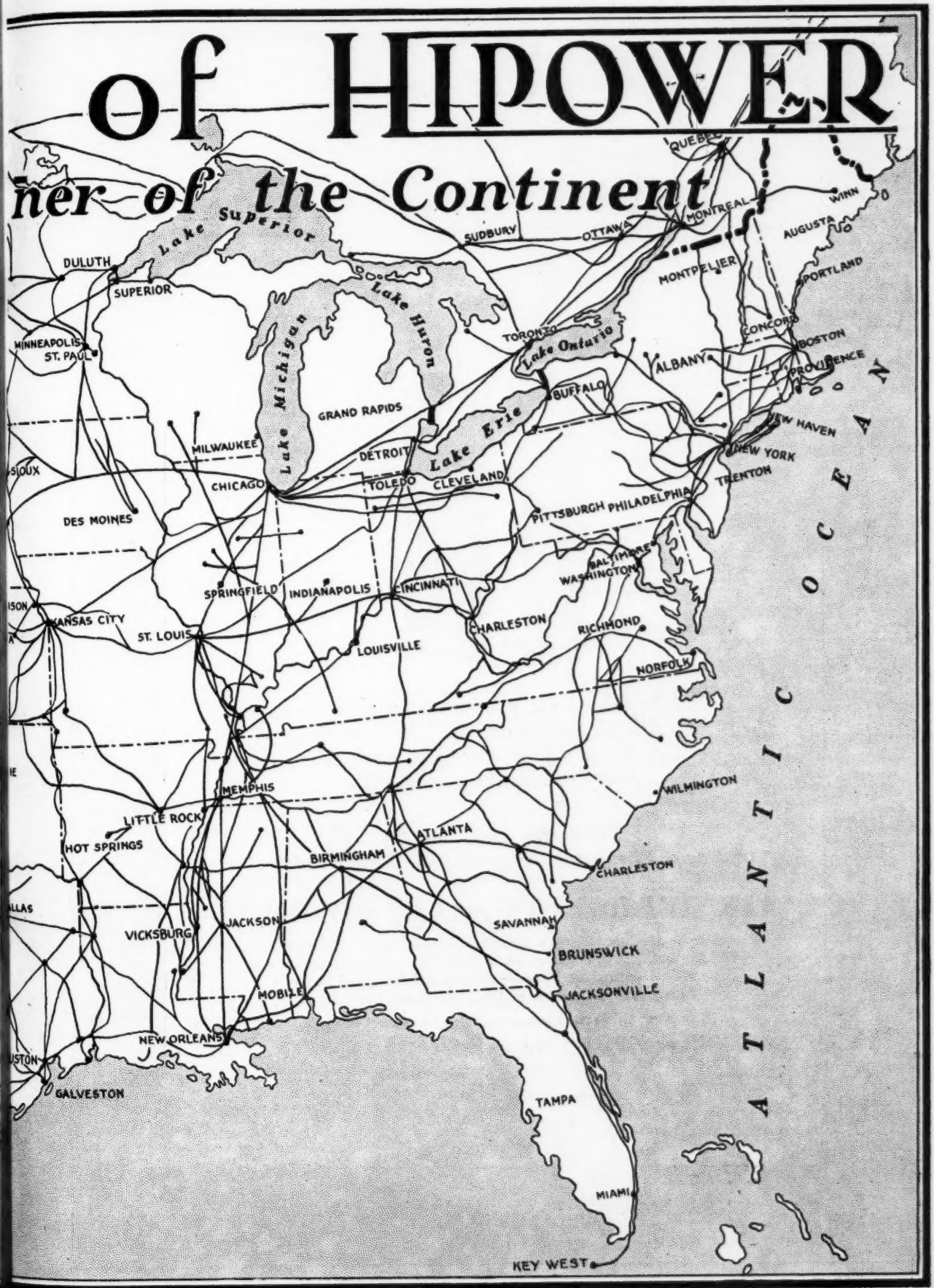
PACIFIC OCEAN


of HIPOWER
ner of the Continent
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FOR OXYACETYLENE WELDING AND CUTTING

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Home Office: 342 Madison Avenue, New York, N. Y.

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Air Reduction Sales Company maintains its own Apparatus Repair Shop in each Airco District Office City.

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Pneumatic Tie Tampers—

"Keep the track in better condition"

Says a prominent engineer. Furthermore—"Each outfit will do the work of 15 men tamping ties. They also can be used as air compressor outfits for running drills, air hammers, paint sprays, etc. Paint sprays do the work of at least 10 painters."

The opinion of other engineers on many of the foremost railroads have been equally as favorable. Actual service tests and accurately kept cost records have proved to them that Pneumatic Tie Tamping Outfits reduce track construction and maintenance expense.

Ask us for further details.

Meet us at the Roadmasters' Convention.

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MAINTENANCE
CONSTRUCTION
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MOTOR CARS

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GET DAYLIGHT SPEED ON NIGHT WORK

NINE MEN IN THE DARK
OR
FOUR MEN WITH A V. G. LIGHT

NO FIRE NO MESS IF UPSET JUST RIGHT IT RELIGHT IT GO AHEAD

TURN OFF AND ON AGAIN ANY TIME TILL WHOLE CHARGE IS USED UP

See it on the Mezzanine Floor

The V. G. Flood Light

Manufactured by

The Blake Manufacturing Company

LIGHTING AND COOKING IN HOME AND CAMP
WELDING AND CUTTING IN SHOP AND FIELD
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Mansfield, Pa.

THE NEW WOOLERY
"PULLAWAY"

Ball-Bearing Engine for Railway Motor Cars

On Exhibit at Hotel Sherman, Space 6-7, Sept. 18-20

All of the best time-tried features are incorporated in this new model:—

UNIT SPEED CONTROL
PRESS BUTTON TYPE SHIFTING LEVER
WOOLERY PATENTED SLIDING BASE
WELDED STEEL FROST-PROOF WATER JACKET WITH FILLING FUNNEL, CLOSED TOP AND NON-FREEZE OVERFLOW PIPE
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NON BACK-FIRE THROTTLE VALVE
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DROP-FORGED STEEL CONNECTING ROD
BALL-BEARING CRANKSHAFT WITH GUARANTEED LEAK PROOF METALLIC PACKING.

Made in four sizes rated at 5, 7½, 10 and 15 H. P. and they develop 40% more than their rating.

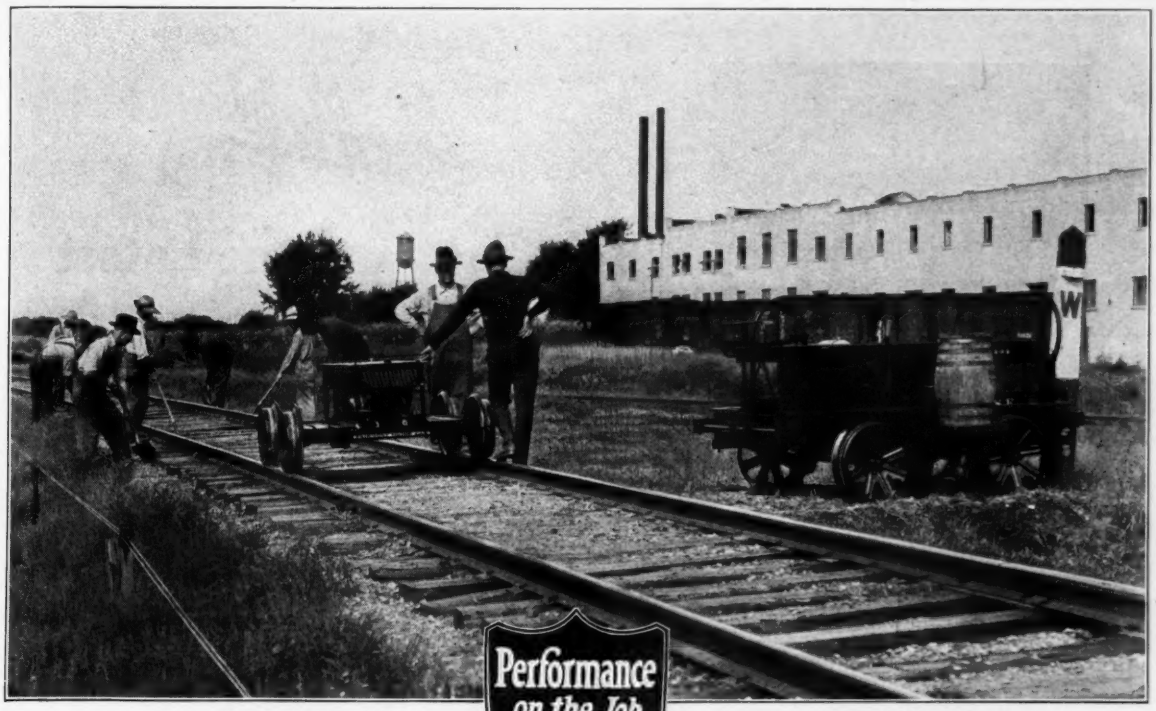
These Engines are furnished mounted on planks or installed on Railway Motor Cars of new design. Chrome Nickel Steel Ball-Bearing Axles, Channel Steel Sub Sills, Truss Frame Construction, Automobile Type Band Brake, and a Dozen of the Best Safety Features distinguish WOOLERY cars.

Don't fail to inspect them thoroughly while attending the Convention.

Feel at home at our Booth (No. 6-7), Hotel Sherman. You are welcome. Write for big new circular describing our Ball-Bearing Engines and Railway Motor Cars.

WOOLERY MACHINE CO.

2921 Como Avenue, S. E., Minneapolis, Minn.



Inspection Car—M19

Performance on the Job Counts

Section Car—M2

"If All My Cars Were Fairmonts"

Said a motor car maintainer, "I wish all the cars on my district were FAIRMONTS, my job would be easier."

What a wealth of meaning in his words. True, they were expressed because of a selfish motive, but think what the real significance of this maintainer's statement is.

Think what it would mean to this maintainer's RAILROAD if it were completely equipped with Fairmonts.

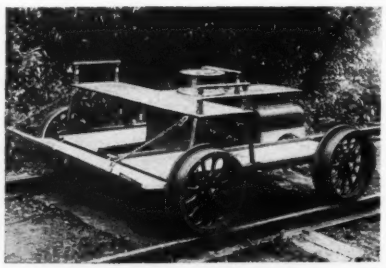
Today hundreds of progressive carriers are making maintainer's jobs easier and maintenance costs lower by standardizing on Fairmont equipment.

FAIRMONT RAILWAY MOTORS, INC., FAIRMONT, MINNESOTA

Descriptive Bulletins of Entire Line Supplied at Your Request

Fairmont

Ball Bearing Motors and Railway Motor Cars



Sheffield

The Original
No. 5 CAR
(Brought out in 1900)
Weight, 470 lbs.

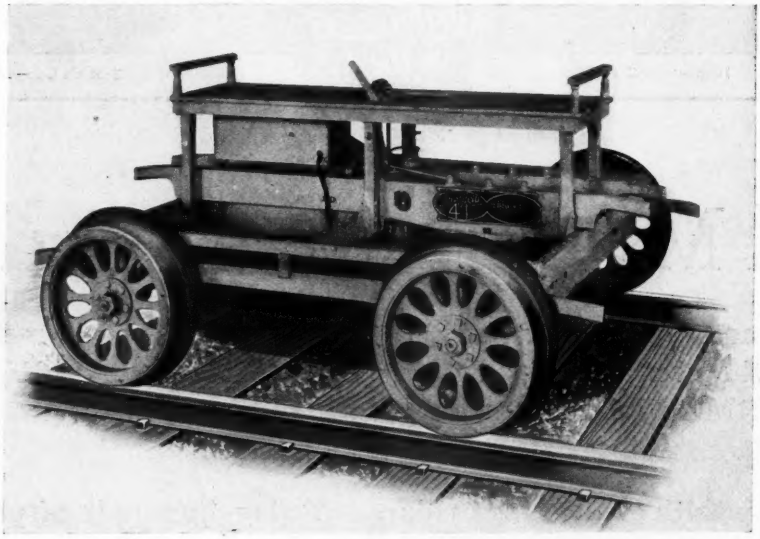
Sheffield

The First and the Latest

Center Load Type

LIGHT INSPECTION CARS

The first center load inspection car in successful service was the SHEFFIELD No. 5—built in 1900. And to-day the acknowledged biggest success in the inspection car field, is the SHEFFIELD No. 41 Center Load car.



Sheffield

The Modern
No. 41 CAR
(Brought out in 1918)
Weight, 460 lbs.

A Few of the Reasons Why

Engine is supported by independent engine sills resting on the cross sill, reinforced with angle iron—prevents deflection of axle.

Automatic priming and lubrication.

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Accessibility of parts.

Simple and dependable fuel injection device—no springs—no wearing parts.

Simple, two-cycle, valveless engine, runs car in either direction.

Meets every essential safety requirement.

FAIRBANKS, MORSE & CO.

Manufacturers—Chicago

What the JORDAN is doing on the New York Central where nine new Jordans have been put to work since the last roadmasters' convention.

Before

During

After

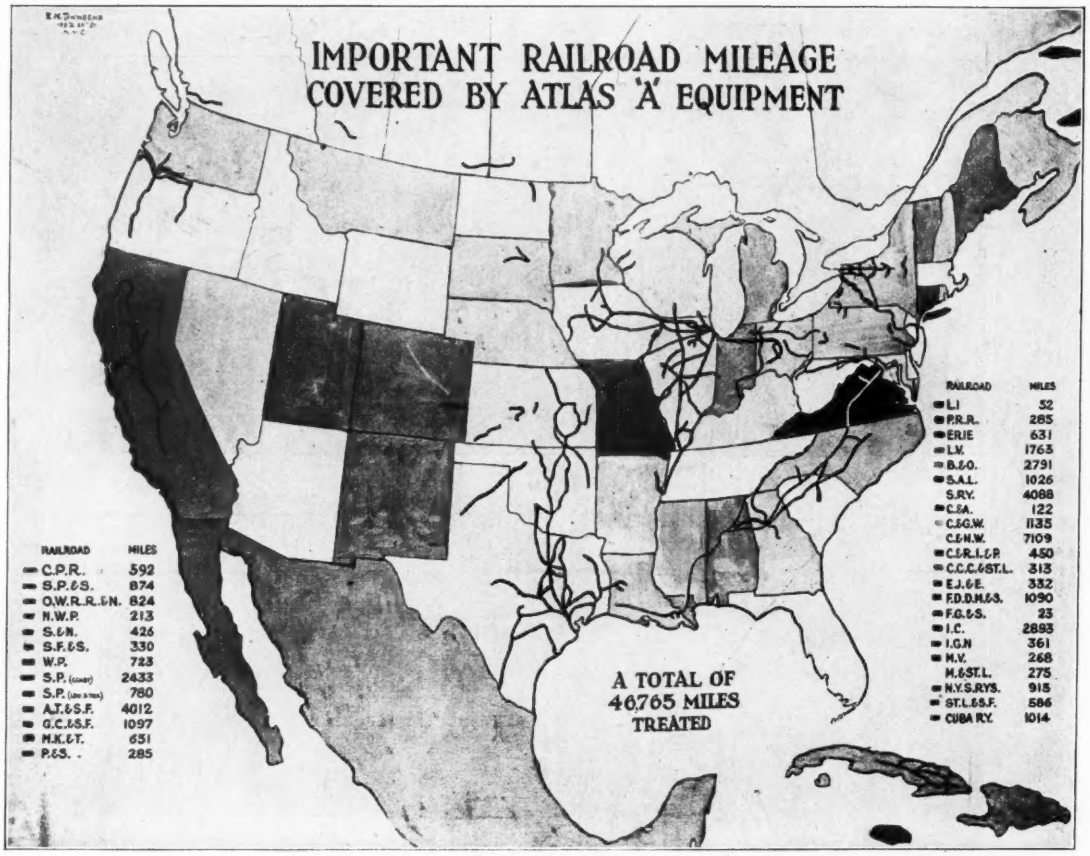
Jordan Spreader Ditcher Snowfighter Ice Cutter

"The Jordan does the work of an army of men"

O. F. JORDAN COMPANY

EAST CHICAGO INDIANA

ATLAS "A" WEED KILLER



BOOTH 39 HOTEL SHERMAN

THE GOSPEL OF THE "CLEAN TRACK"

SEPTEMBER 18, 19, 20

THE Gospel of the "Clean Track" has been preached most effectively by those officials who have adopted **ATLAS "A" WEED KILLER,** the standard in American Railway practice since 1909.

A glance at the above map indicates clearly where **ATLAS "A"** has been applied. The fact that roads and mileage shown have and are being treated by **ATLAS "A"** is a guarantee of practice and results.

A railroad is not experimenting in contracting for **ATLAS "A"**—it is buying ***insurance*** of clean, sound track. Many officials have seen our service at work this past summer; many more will see it next summer. And it costs less than handweeding!

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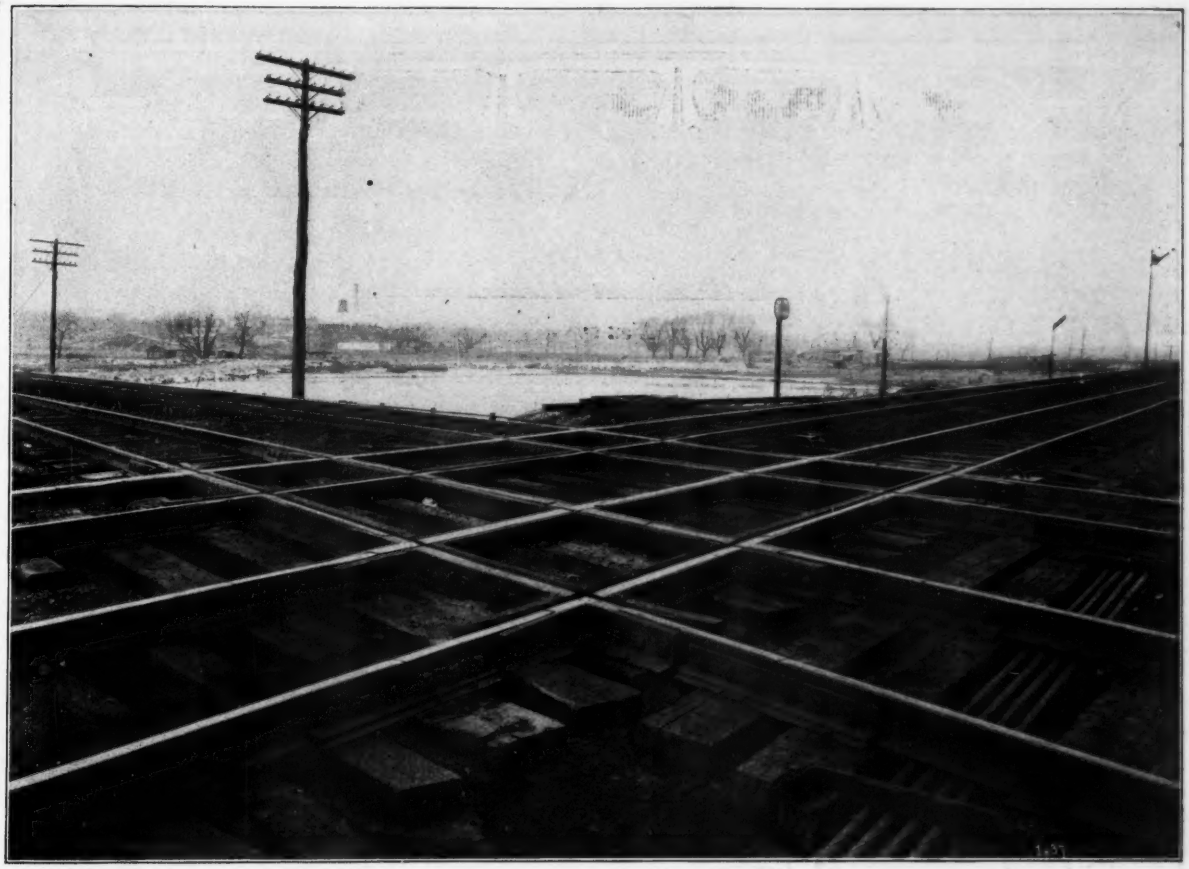

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After they had been in service for 60 days you asked for a report from the supervisor on the attention the new bolts needed and your report came back:—

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Selflock Nut and Bolt Co., Inc.

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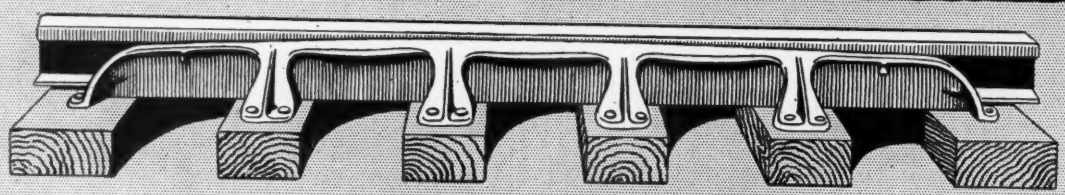

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Ramapo and **Ajax** specialties have been long and favorably known under their individual names as manufactured by Ramapo Iron Works and Ajax Forge Company. These two companies are now consolidated into Ramapo Ajax Corporation, with five completely equipped works conveniently located for prompt deliveries to the railroads of the country. To assure service in the Western territory a stock of Ramapo Automatic Safety Switch Stands is carried at the Chicago headquarters.

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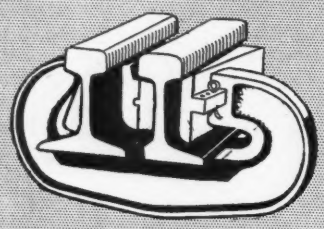
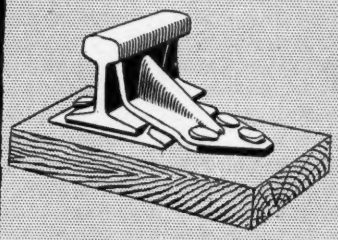
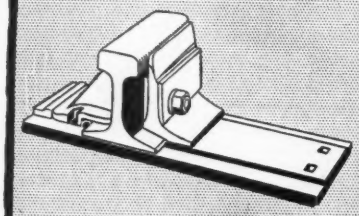
Particular attention is directed to the Ajax One-Piece Guard Rail t top of this page. Its combined simplicity and rigidity make this the most efficient and economical installation.



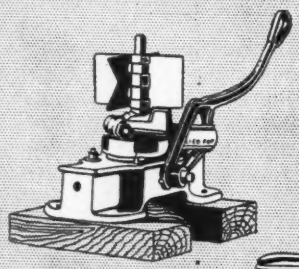
RACOR FORGED
HEAVY DUTY
GUARD RAIL CLAMP



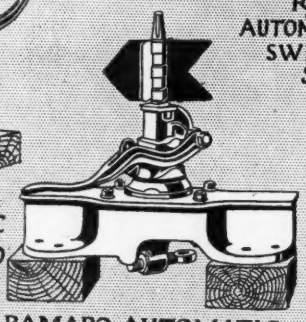
RACOR
FORGED RAIL BRACE



RACOR DOUBLE SHOULDER
SOLID BOTTOM
SWITCH RISER PLATE



RAMAPO AUTOMATIC
SAFETY SWITCH STAND
Style No 20-B



RAMAPO AUTOMATIC
SAFETY SWITCH STAND
Style No 19

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AUTOMATIC SAFETY
SWITCH STAND
Style No 18

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THE IDOL TRACK LINER

Illustration No. 1

Showing the Liner in position against the rail in track. The liner is set at an angle to permit the farthest throw of the track. If the track must be moved more than 1½ inches, the Liner should be reset for each throw.

Illustration No. 2

Showing the Idol Track Liner in use as a tie spacer.

Illustration No. 3

Showing the Idol Track Liner raising low joints.

Illustration No. 4

Showing Liner in position at end of tie. Use Liner in this manner at switch points, or where spacer straps do not permit contact between the Liner and the base of the rail.

Illustrations numbers 5 and 6 show the proper placement of Liners to line frogs. Place three Liners against outside rail in direction of throw, two Liners against frog and two Liners against inside rail. The work of lining can be done with one-third the number of men required when using lining bars. This work usually takes a greater period of time with 15 to 21 men using lining bars than is taken by 7 men when using Idol Track Liners.

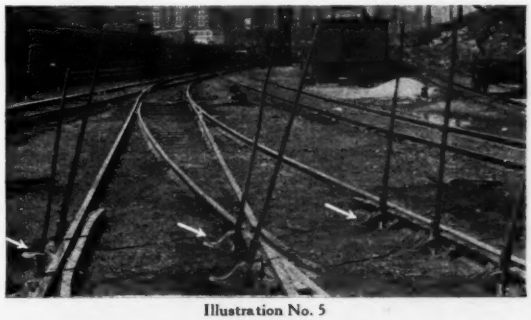


Illustration No. 5

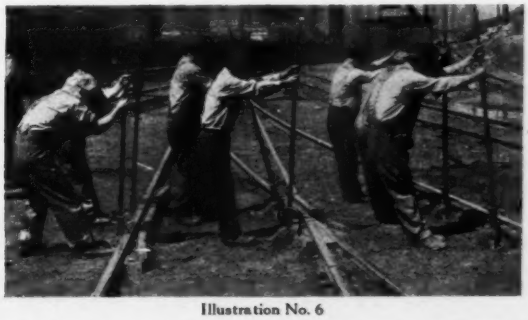


Illustration No. 6

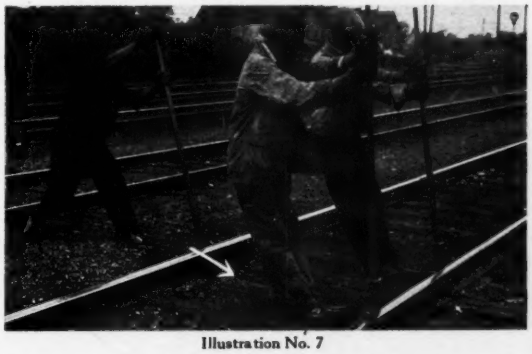


Illustration No. 7

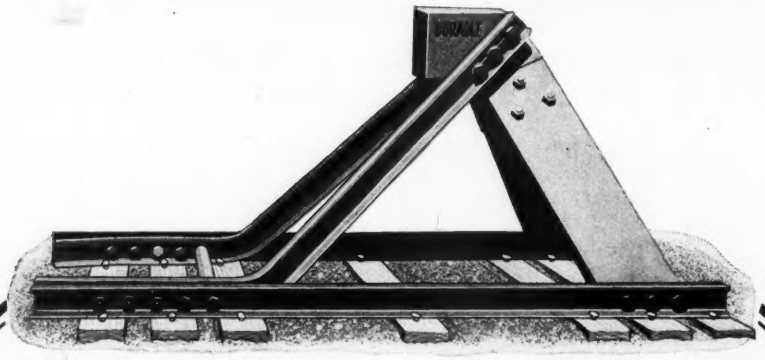
Illustration No. 8

Illustrations numbers 7 and 8 show the lining of ordinary track. Set two Liners against outside rail in direction to be lined, and one against inside rail.

Illustration number 7 shows three men doing the same work with Idol Track Liners as was formerly done by seven to nine men with lining bars. The seven men using lining bars shown in illustration number 8 could not line the track; the three men with Liners moved the same track easily, without digging out the ballast at the end of the ties. When section crews are reduced to three men, all ordinary track can be lined without waiting for the organization of full forces, and without the doubling of section crews.

IDOL TRACK LINER CO.

Thomas D. Crowley & Co., Gen'l Sales Agents **122 S. Michigan Ave., Chicago, Ill.**



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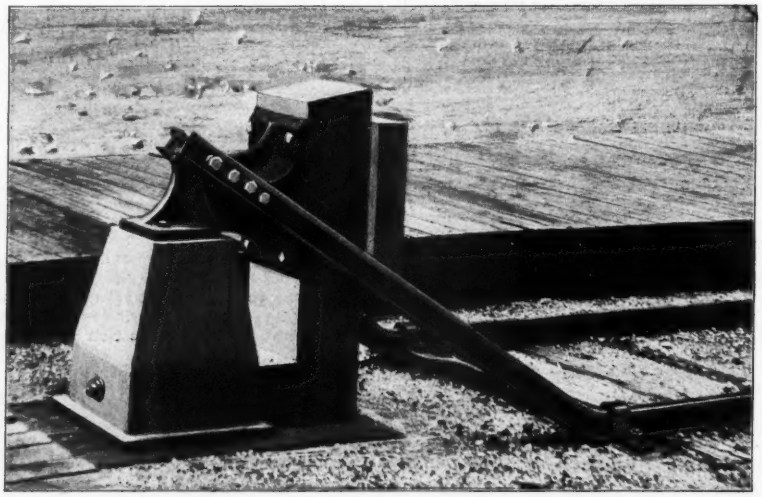

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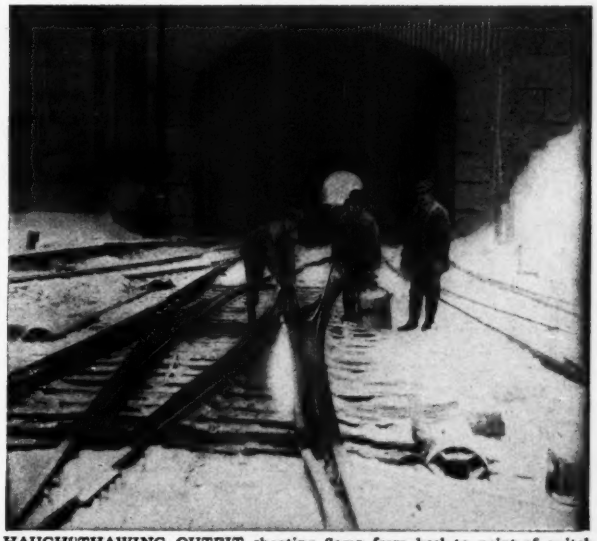
In satisfactory use since 1917



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(To Users: Now is the time to inspect your Hauck thawing equipments)

For rapidly clearing switches of ice and snow the HAUCK Kerosene thawers have been adopted by the leading Railroad Systems. *The forced flame of these torches makes the sleet and ice* packed in the switch points and various parts of the switch mechanism, cranks, pipe lines, etc., *yield more readily* than any other method. The torches and burner equipments are:—

SAFE—because each tank is equipped with a safety pump check valve which ceases to function (absolutely no air entering into the tank) after the desired pressure is obtained.

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Write for bulletin No. 117. It illustrates all sizes.

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Established 1900

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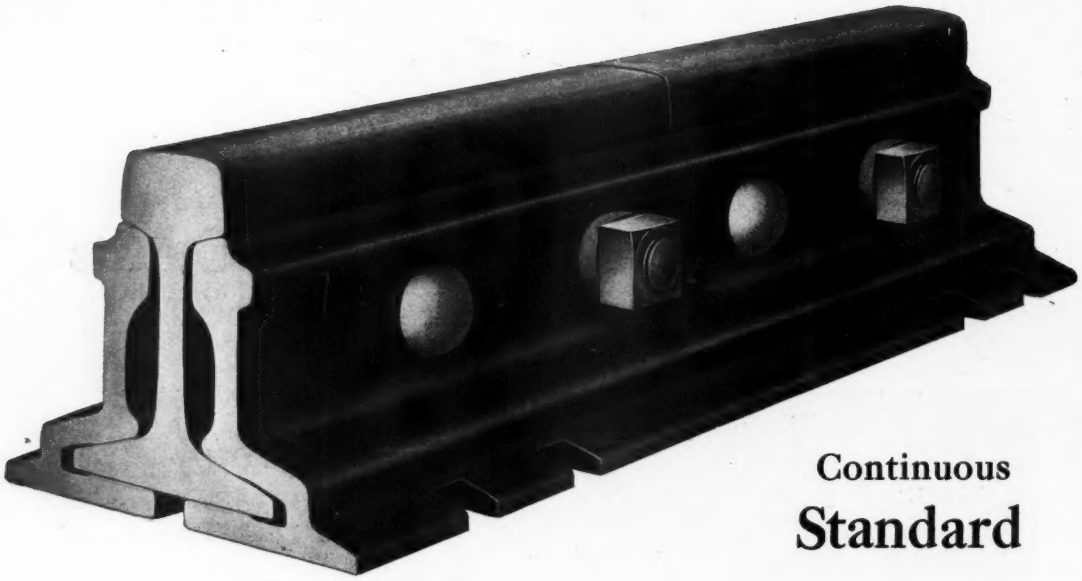

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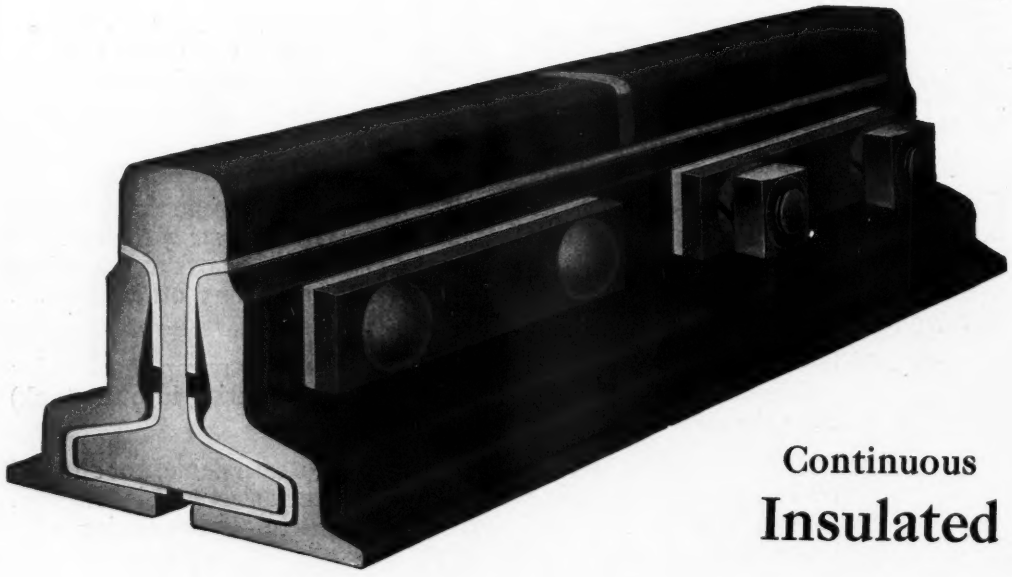
Safety—Durability—Economy



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The Rail Joint Company

61 Broadway New York City

Railway Engineering and Maintenance

Volume 19 October, 1923 No. 10

RAIL FAILURES IN GREAT BRITAIN AND AMERICA

ON the railways of Great Britain, comprising more than 25,000 miles of line, less than 200 rail failures occur annually or an average of less than four per week. In contrast with this, statistics compiled by the American Railway Engineering Association show an annual rate of failures in the United States and Canada of approximately 20 per 100 miles of track or more than 25 times as many as in England. It is true, of course, that the wheel loads in that country are much lighter than those in America, but the speeds are as great or greater and the density of traffic much greater and the weight of rails is less than in this country. More important, however, are the facts that the tracks in that country are maintained to higher standards than prevail here and also that more care is taken in the production of the rails there than here. This contrast places railway maintenance men and steel manufacturers in America in an unfavorable light which they should hasten to rectify by perfecting those methods which contribute to our present unsatisfactory record.

PREPARE FOR CONTINUED HEAVY SERVICE

NEARLY 50,000 more men (48,139, to be exact) were employed in the maintenance of way and structures in June, 1923, than in the same month of the preceding year. This indicates the extent to which the improvement programs of the roads have been enlarged over those of preceding years. Some of this increase has gone to make good the greater wear and tear resulting from the record traffic, but much of it has gone into the real betterment of the properties and to the taking up of the accumulation of deferred maintenance of the last few years.

Every indication points to the continuation of this heavy traffic indefinitely. This is leading many roads to undertake new construction projects whose completion will require all of next year, indicating their confidence in the business outlook for 1924. Because of the heavy traffic now being handled and that in prospect for this winter, the wear and tear on the tracks and structures will be unusually heavy and it is none to early to give thought to those measures which should be taken to bring these facilities into condition to withstand this traffic without undue deterioration. Much can be done in the few weeks that remain before the arrival of cold weather to remedy deficiencies in line and surface, to improve drainage, to renew worn parts and to take care of those details which are most likely to cause delay in the winter.

The work of an emergency characted will be least on those districts whose supervisors have most fully anticipated the demands and have taken the necessary precautions to protect themselves accordingly. That road will be able to produce the maximum amount of transportation and to produce it most economically whose maintenance forces have so maintained their properties as to result in the minimum number of failures, reflected in derailments and delays to trains.

WE ARE MAKING PROGRESS

THE maintenance officer engrossed in the daily routine of his duties is often prone to become discouraged with the seemingly slow progress which is being made in the application of mechanical equipment to the work under his charge. However, if he will take a little time for retrospection, he will see that genuine progress has been made. It is only necessary to review the proceedings of former conventions of the Roadmasters' Association to get a clear conception of the changes which have taken place within the last ten or twelve years. Thus, in discussing the subject of motor cars as recently as 1912, the members of this association manifested no little doubt as to the practical value of this now standard equipment in maintenance of way work, and as to the ability of the average section foreman to master the intricacies of this piece of machinery, they even considered the advisability of providing these cars with levers so that the gang could get over the road with it in case it refused to work.

But this does not mean that the roadmasters of 1912 were not keenly interested in the possibilities of developing mechanical equipment as an aid in the conduct of maintenance of way work. On the contrary they were just as earnestly in favor of improved methods and equipment as they are today. The difference is simply that the roadmaster of the present, if he will stop to consider what has actually been done, is confronted with many tangible evidences of the progress which has been made and which should convince him that the future holds out still more encouraging possibilities.

HOW TO TRAIN SECTION FOREMEN

HOW much experience should a man have before he can be promoted to a foreman? What is the best manner of attracting men of the proper ability into the service? It is advisable to give a prospective foreman special training by moving him from one gang to another? Is an apprentice system practicable? These are some of the questions confronting every railway officer responsible for the selection of men for the position of section foreman today.

In the past the problem was simply that of choosing the man best fitted from a number of capable employees. Today it is that of inducing enough men of the proper caliber to enter and to remain in the service for a sufficient length of time to enable them to qualify for this responsible position. That there is a shortage of fore-

men is the almost universal complaint. That some means must be adopted to remedy this is equally evident.

In order to direct attention to this problem and to stimulate interest in its solution, we have announced a contest on "The Training of a Section Foreman." Prizes of $25 and $15 will be paid for the two best papers received, the award being based on the practical value of the ideas presented and the readiness with which they may be applied. All contributions should be sent to the editor of *Railway Engineering and Maintenance*, 608 South Dearborn street, Chicago, and must be received by October 10.

THE PILE TRESTLE IS STILL WITH US

JUST when, where, and by whom the first pile trestle was built is not known, but history records the fact that a bridge over the Tiber at Rome, the Pons Sublicus built in 621 B. C., was a structure in every way similar to the pile trestle of today. It is clear, therefore, that the pioneers of American railroads did not originate the pile trestle so often applied in their work, but simply adapted something that had been common usage in highway construction. Such changes as have been made were solely to increase the strength, the stringers in particular being made much larger than anything used before the days of the railroads.

But, in spite of its great antiquity and notwithstanding the large expenditures which the railroads are making from year to year for the purpose of replacing wooden structures with those of a more permanent character, the pile trestle retains an important place among railway structures. It is only necessary to read the article on the Great Salt Lake trestle, which appears on page 382, of this issue, to appreciate this fact. After a service of nearly 20 years, only the deck of this long bridge has deterioriated to a degree requiring its renewal. The bents apparently are as good now as at the time they were driven. Moreover the measures taken to protect the new stringers from decay insure a greater life than those recently removed from the old deck.

Of course the conditions at Great Salt Lake are most unusual and the service rendered by the Salt Lake trestle is no criterion of the results to be secured elsewhere with untreated timber. But it must be remembered that the immunity to decay obtained in the Lucin cutoff structure as a result of saturation with highly concentrated salt water can be substantially duplicated in other structures with the use of commercial creosoting processes. The real lesson in the Salt Lake trestle is the remarkable illustration it affords of the thoroughly practical utility of the pile trestle as a structure carrying heavy railway traffic. For the oft-raised question as to the possibility that this trestle may be eventually replaced by an embankment such as is used for a part of the lake crossing, the only answer is that the bridge structure has proved less troublesome and expensive to maintain than the embankment.

GETTING FULL RESULTS FROM WINTER FORCES

THE season is approaching when maintenance officers must begin to plan for the curtailment of their activities and for the reduction of their forces to a winter basis. They are completing a busy year's program. All indications point to an equally active season in 1924. Yet a large part of the force must soon be disbanded with the knowledge that new gangs must be recruited in their place a few months later. This condition does more to reduce the efficiency of maintenance forces than any other single influence, yet it is in large measure inherent to work which is so largely seasonal.

Maintenance men have long complained about this condition. They have contended that they could secure more efficient men if they could offer them permanent employment throughout the year. But in general they have not presented to their higher officers a detailed program of work on which these men could be employed constructively during the winter and which would reduce the work to be done the following summer to a corresponding extent. As a result, the managements have naturally concluded that the added cost of carrying these men during the winter is not justified.

Much of the work of building and maintaining tracks and structures is seasonal in character and can be done most economically during the summer. There is, however, a considerable amount of other work which can be done almost if not equally well during the winter if proper preparations are made in advance. Before asking for a larger winter force, however, it is incumbent on the advocates of this plan to demonstrate their ability to keep constructively employed all of the men which it is already the practice to retain on a winter basis. This many have failed to do—not in general because there was not work to do, but because it has not been properly planned.

It is necessary to maintain a sufficient winter force on every road to cope with storms and other emergencies. It is frequently the case that these men do little work of other than a temporary character between these storms. On the other hand, the progress which some roads and some supervisors have made has demonstrated that much work can be done between these emergencies which will relieve the forces during the following summer. Some roads lay all or part of their rail during the winter with gangs formed by the consolidation of section forces. Some roadmasters get all of their ties distributed during this season by encouraging their foremen to work them out with their motor cars. An analysis

HIGH SPOTS OF RAILROAD SERVICE

For a little more than three cents, or scarcely more than the price of a daily newspaper, the railroads carry a passenger one mile, together with 150 lbs. of baggage. To do this they provide approximately 9,000 lbs. of vehicular equipment for each passenger.

For about one and one-tenth cents the railroads carry an average ton of freight one mile. To move the ton of freight requires an average of 1,700 pounds of car.

The Class I railroads (those with gross earnings of more than $1,000,000,000 annually) carried 339,730,198,000 tons of revenue freight a distance of one mile in 1922. This is equivalent to carrying one ton of freight a distance of 3,088 miles, or from Philadelphia to Los Angeles, for every man, woman and child in the United States.

To pay the average railroad employee's wage last year, which was $1,622, it was necessary for the roads to haul one ton of freight 137,925 miles, or more than 45 times across the American continent.

of the work done by the average section force will indicate other tasks which can be completed at this season. Maintenance supervisors can effect real economies in their operations by giving this subject more careful attention than it has commonly received.

MAKE GREATER USE OF THE MOTOR CAR

THE heavy burden of traffic now imposed on the railroads makes it imperative that the maintenance of way officer dispense with the use of work trains wherever this is physically possible. Because of the expedients which supervisors have had to improvise recently in order to get their work done, serious questions have been raised in the minds of many of them regarding the justification for work train service, even when operating conditions do not demand their curtailment. In the past, the employment of special trains for maintenance operations has been considered virtually a necessity and the roadmaster and his superior officers have taken it for granted that the work could not be done without them. This is a natural outgrowth of practices which developed years ago when train service was not nearly as expensive as it is today and when traffic was so much lighter that the presence of these additional trains on the line imposed no particular obstruction to the movements of regular trains.

But times have changed, and the enormous volume of transportation today not only imposes a serious obstacle to the use of work trains but demonstrates how exceedingly expensive they are. The officers of some roads have been keenly alive to this condition for some time and have developed measures to effect a marked reduction in their use. The motor car, in particular has been put to more extended service as a substitute.

As occasions develop, the motor car has been used by section foreman for the distribution of ties, instead of unloading them along the track from the cars in which they were delivered, either by the aid of a work train or the local freight. To make this plan effective it is necessary to do some careful planning. Obviously a section foreman cannot distribute the ties in sufficient quantities during the active renewal season without detracting from his other work because the number inserted each day is greater than the gang can carry out economically on its section car from headquarters each morning. The most practical plan is for the foreman to begin the delivery of the ties during the winter, taking a small number out each morning on his way over his section. The number of ties that can be handled in this way depends upon the size of the gang. If there are enough men to permit the movement of a trailer with the motor car, more ties can be delivered than if the gang uses the motor car alone. The testimony of supervisors who have followed this practice indicates its entire practicability. Experience shows that a foreman can readily distribute all of the ties alloted to him without making any trips over the section with the car other than those necessary for his routine maintenance operations during the early spring months.

This is an example of many measures which may be adopted for the curtailment of work train service. In busy terminals this plan might not be practical, but here the use of the motor truck traveling over city streets offers further possibilities. It is not to be expected that any one "cure all" will be developed which can be applied indiscriminately without serious consideration of the local conditions. Each case must be considered on its merits, but the important point is for each maintenance of way officer to take serious account of the methods he uses to see if some of them have not grown obsolete.

Letters to the Editor

WHY COVER OUR TIMBER BRIDGES WITH SHEET IRON?

Fargo, N. D.

TO THE EDITOR:

If it were possible to replace all wooden trestle bridges with reinforced concrete trestles, the fire hazard would be eliminated, but this is impracticable. The ballasted deck timber trestle is also expensive in first cost, as well as costly to maintain. As a result, railroads will continue to have the problem of fire-proofing their timber trestles.

In fire-proofing a wooden bridge, why should it be assumed that the entire deck must be covered with iron? *Covering the deck with sheet iron makes inspection difficult* and interferes with track circuits. Moreover, a case has been seen where a bridge set afire by malicious persons was burned sufficiently under the iron covering to be unsafe for traffic before there was appreciable evidence of this condition showing through above the sheet iron. There are thousands of steel bridges in this country with timber guard rails and ties and no one thinks of covering the decks with sheet iron for fire protection.

The ordinary timber trestle may be protected against fire in a more satisfactory manner by covering the top of each chord and also the caps with sheet iron and letting the iron lap over sufficiently to cover the projecting ends of braces where they attach to the caps. In other words, covering the places where wood touches wood eliminates most of the chances for fire. EDWIN M. GRIME,

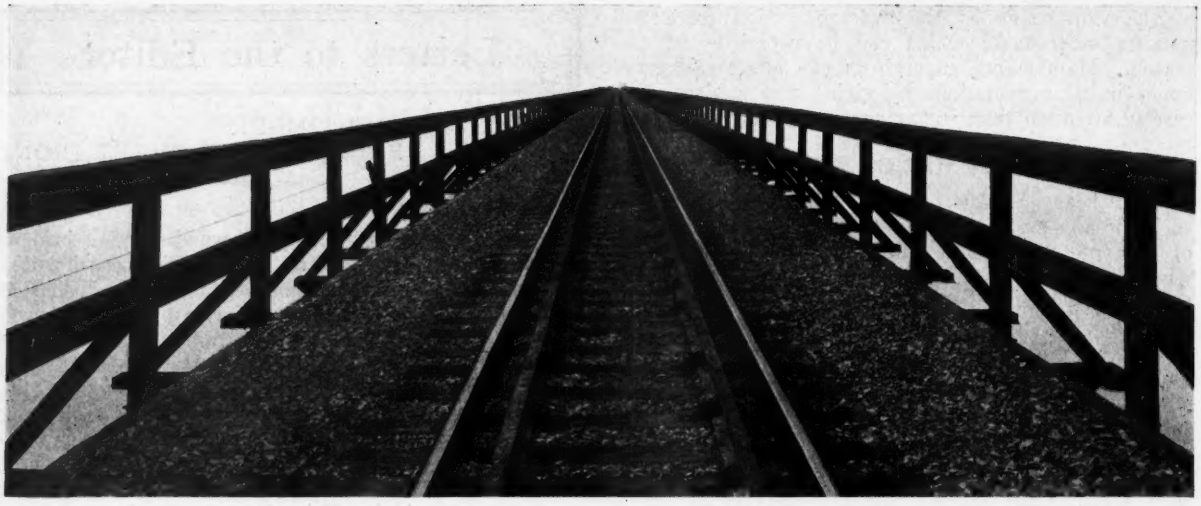
Supervisor Bridges and Buildings, Northern Pacific.

NEW BOOKS

Structural Members and Connections. By Geo. J. Hool and W. S. Kinne, professors of structural engineering, University of Wisconsin, Madison, Wis., editors-in-chief. 611 pages, 6 in x 9 in., illustrated. Bound in cloth. Published by the McGraw-Hill Book Company, 370 Seventh Avenue, New York.

This is the second of a series of six volumes prepared under the direction of the editors-in-chief by a large staff of contributing editors for the purpose of providing engineers in practice and engineering students with a complete work covering the design and construction of "civil engineering works." From the title of this book, "Structural Members and Connections," one would naturally infer that it comprised a treatise on the more detailed problems of structural designing and implied a thorough knowledge of the elements of structural design by the reader. Instead, the book may be characterized as a general text on the theory and practice of frame structures.

The presentation is excellent. The general discussion covered in the first 171 pages summarize the mechanics of materials as applied to structural design in a thoroughgoing manner. The publishers also deserve particular commendation for the typography and excellence of the illustrations. The chapters on the design of plate girders cover the subject with a thoroughness well up to the expectations created by the title of the volume, but a total of only nine pages on the subject of steel columns is rather disappointing. One section of 130 pages is devoted to the subject of reinforced concrete, and although prepared to a high standard, embodies little to differentiate it from other texts on the same subject that warrants its inclusion in a book entitled, "Structural Members and Connections." The chapter devoted to wooden structures shows painstaking care and would seem to fulfill the requirements set up by the title of the book.



Salt Lake Trestle in Its Relation to the Lake and Its Surroundings.

How the Southern Pacific Maintains the Salt Lake Trestle

Unusual Character of This Body of Water Insures Long Life of the Timber Construction

THE SALT LAKE trestle is numbered among the remarkable railway structures in the United States, not only because its construction imposed a most formidable problem in the prosecution of a famous railway project, the Southern Pacific's Lucin cut-off, but also because it crosses a body of water possessing characteristics scarcely to be duplicated anywhere else on the face of the earth. Containing one pound of salt to every five pounds of water, or about seven times as much as that contained in sea water, it presents conditions unlike those encountered in any other waterway structure. In fact, it is only because of some of the remarkable divergences from the ordinary that a trestle could be built across this lake, and while, therefore, the story of building of this trestle was one of unusual human interest, an account of the problems imposed in its maintenance and of the manner in which the deck is now being renewed are of equal, if not greater, interest to railway maintenance officers.

To obtain a thorough grasp of the fundamental conditions affecting the maintenance of this remarkable bridge, the reader must possess a background of facts concerning the lake and circumstances attending the construction of the trestle. In modern history, Great Salt Lake is definitely linked with the advent of the Mormon elders who transformed its eastern shore from a desert into a garden spot. Later it was associated with the completion of the first transcontinental railroad, since the driving of the last spike in closing rail communication between the east and the west took place at Promontory, a station a few miles from its north shore, on the detour which it was necessary to build around the north end of the lake.

Bottom of Lake Is Practically Level

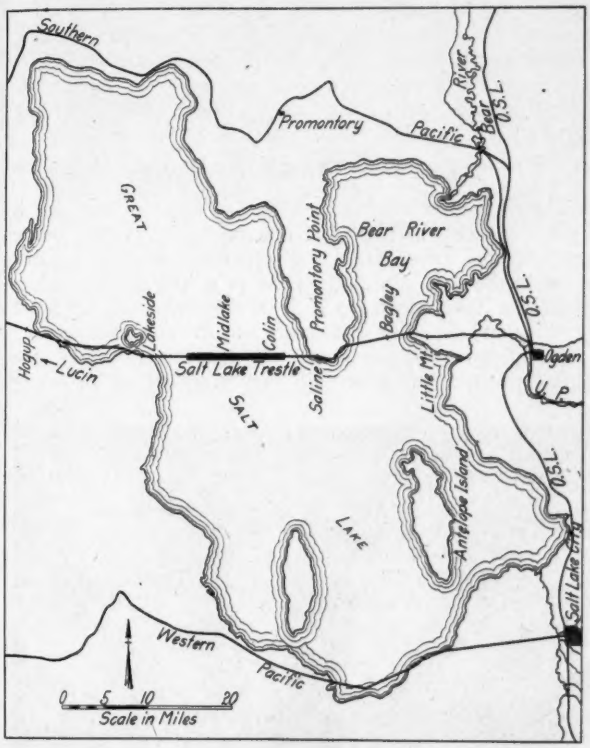
Great Salt Lake is 75 miles long, north and south, by 31 miles wide, east and west, and has an area at the present time of about 1,960 square miles. Although mountains many thousands of feet in height border its shores and project from its surface as islands, the bed of the lake is such a flat plain and so close to the surface that a trestle could readily be constructed across it almost anywhere. On the location chosen for the Southern Pacific trestle, the water is now about 35 to 40 ft. deep, the material in the lake bed being a body of silt from 20 to 60 ft. in depth, overlying a more solid bottom.

Being an inland sea, without an outlet, the level of the water is dependent upon the relation of rainfall to evaporation, and as a consequence the lake level is subject to wide variations with the fluctuation in rainfall. It is estimated that the annual evaporation on the lake is equivalent to a 6 ft. depth of water. The yearly rainfall in the area tributary to the lake varies from 9.34 in. to 28 in., with an average of about 15 in. As a consequence, the water level in the lake has varied as much as 3 ft. in a single year, with periodic variations for a period of years affording a difference of level of as much as 16½ feet,

The New Stringers Were Given a 90-Day Bath in the Waters of the Lake

this occurring in 1868 and a few inches less in 1877. It is a noteworthy fact, in this connection, that the level at the time of construction, 1901 to 1903, was the lowest since records have been kept, beginning in 1850. The present level is fully 9 ft. above that of the construction period and is the highest since 1890.

The extreme uniformity in the level of the lake bed has its explanation in the great body of water of prehistoric times which occupied an area much greater than the Great Salt Lake of today. This inland sea, known by geologists as Lake Bonneville, had an estimated depth of 1,200 ft., a length of 346 miles, and a width of 145 miles, and the process of sedimentation in this ancient sea, which produced the level bottom of Great Salt Lake, also formed great areas of what are now dry lake beds extending for many miles beyond the shores of the present lake. It



Map Showing Where Track Crosses the Lake

was, no doubt, the shallowness of the water of Great Salt Lake together with the wide stretches of dry lake bed to the west of it which led to the original plans for the Lucin cut-off, whereby a location extending almost in a straight line from Ogden to Lucin, a distance of 103.8 miles, was developed as a substitute for the old detour location at a saving of 43 miles in distance, 1,515 ft. of rise and fall, and nearly 4,000 deg. of curvature.

Crossing Consists Partly of Embankment

The portion of the cut-off extending across the lake is approximately 30 miles in length, of which about 5 miles comprise a line skirting the end of Promontory Point, a mountainous peninsula extending from the north which cuts off Bear River bay from the body of the lake and divides the lake crossing into two sections. The crossing of the lower end of Bear River bay comprises a distance of approximately 8 miles, while that extending across the main body of the lake, 20 miles long.

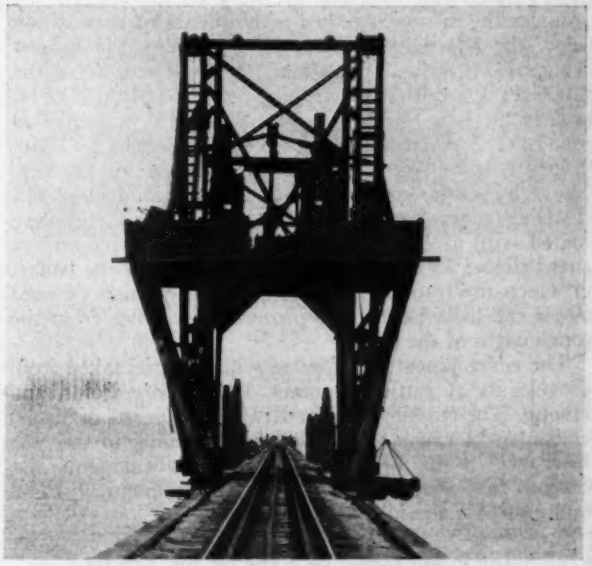
Originally 22.94 miles of trestle were constructed, of which 11.1 miles were intended to be permanent and 11.84 miles to serve as a temporary structure for filling operations incident to the construction of an embankment. Owing to the difficulty encountered in making the fill under traffic, which commenced to use the cut-off before

Midlake, the Headquarters for Some of the Maintenance Forces and Their Families on the Trestle

the filling was completed, .76 miles of the temporary trestle was converted into a permanent structure, making the overall length of the trestle 11.86 miles. The trestle is single track except for double passing tracks at Colin and Midlake and a section of double track near the west end. The total length of trestle reduced to single track is 15.1 miles.

The Structure Is a Ballasted Deck Trestle of Untreated Timber

The structure is a timber ballasted deck trestle, this type of construction being chosen because it is substantially fireproof, the maintenance costs are low, and the

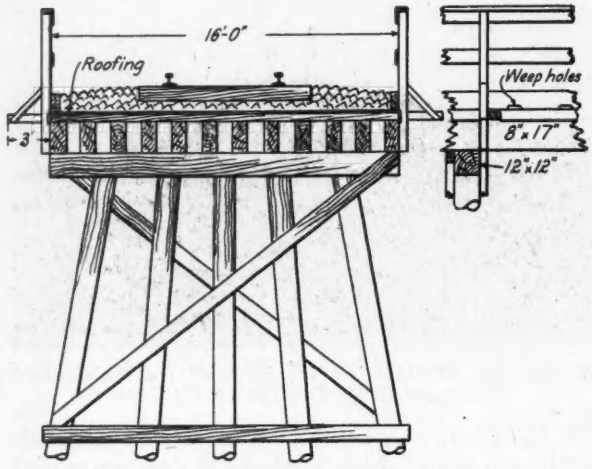


The Gallows-Frame Pile Driver Used to Drive the Brace Piles

track can be kept in line and surface by track forces, while the danger of serious accident in case of derailment is much less than with an open deck structure.

It was considered advisable to use untreated timber, as it was believed that the salt water would preserve the

piles and insure long life for the deck. Moreover the program set up for the completion of the structure involved a rate of construction progress entailing the consumption of timber at a rate that would have precluded the delivery of creosoted material in sufficient volume to keep the work going, as much as 250,000 feet of lumber being used daily for long periods. Experience with the structure subsequent to its completion substantiates the



Details of the Trestle With the New Deck

conclusions reached as to the protection afforded by the extreme salinity of the water of the lake. One reassuring fact in this connection is the almost entire absence of animal life in the lake water. The only animals living in the water are small shrimp, not over one-third of an inch in length, and the larvæ of a lake fly. There was, therefore, no apprehension of difficulty with marine borers.

A depth of water of 35 to 40 ft. and a height of the trestle above water of seven ft. from present water stage to underside of cap, together with a depth of penetration below the lake bottom, required long piles, the longest being 113 ft. 6 in. The standard construction for the single track consists of five piles with a 12-in. by 12-in. cap, 16 ft. long, forming bents spaced 15 ft. center to center. These bents are spanned by twelve 8-in. by 17-in. stringers, spaced uniformly over the length of the cap. The stringers are covered with 3-in. by 12-in. deck planks spanning crosswise and sheathed with four-ply roofing coated with asphalt and curbed along each edge with a guard timber to form a suitable receptacle for the ballast in which the track is laid. A one-inch cushion of sand under the ballast serves to protect the roofing from the rough edges of the stone.

The embankment was formed with material taken from shovel cuts at Little Mountain, Promontory Point, and Hogup. The crossing of Bear River bay consists of a solid embankment except for a waterway opening to take the discharge of the Bear River. Solid embankments also extend for some distance west of Promontory Point and east of Lakeside.

Little Maintenance Expense for Trestle

From 1904 when the causeway was completed in permanent form, until 1918, the structure required no maintenance. The only expense involved for the care of the trestle was for an inspector who devotes his entire time to the structure, patrolling the track and examining the piles and underside of the deck with the aid of a launch. Protection against fire was provided by installing fire extinguishers at suitable intervals containing a non-freezing solution and by providing fire pails, four to the mile, each equipped with a chain so that it may be let down to fill it with lake water. A fire boat is also kept in service for use at any time. The danger of fire, however, is very small, as the upper surface is ballasted and the coating of salt obtained as the result of spray during storms makes the wood more or less fire resistant.

The track on the trestle is maintained by section forces, section gangs being distributed at intervals throughout its length as on ordinary track. One section gang is located at Bagley, another at Saline, two at Midlake and one at Lakeside. Whenever it is necessary to surface track in the winter time, the ballast is thawed out by soaking it with a stream of water from the fire boat. In general, the maintenance problems are much the same as they are on land. The life of ties on the trestle compares favorably with that obtained under similar climatic conditions elsewhere. On the embankment the life is shorter because the spray from storms keeps them saturated a large part of the time and they tend to become soft and crush under traffic.

Embankment Suffers from Wash

The maintenance of the embankment has proved much more expensive than that of the trestle. Although some difficulty has arisen from the settlement of the embankment in the soft lake bottom the principal trouble arises from the lake storms which are sometimes of great severity and do extensive damage to the embankment.

To afford adequate protection to transportation, the embankment is patrolled daily, and whenever a recording

The Spray Produces Deposit of Salt on the Underside of the Stringers

wind gauge in the operator's office at Midlake registers velocities exceeding an established maximum, word is sent to the section forces to double the patrol, so that in event of trouble one man may flag trains, while another proceeds in the opposite direction for assistance.

The washing and settlement of the embankment, due, in part, to the higher level of the lake, has necessitated the adding of a large amount of rock, this work being carried out in accordance with an approved and progressive program from a quarry at Lakeside, where a force of quarrymen and an extra track gang are maintained to carry on this work. This force, is therefore, available for any emergency work in case of damage to the embankment as a consequence of a storm.

The quarry equipment includes a rock crusher, two 5-cu. yd. Bucyrus shovels for handling rip-rap stone; one 1½-yd. Marion shovel for handling ballast stone; a stiff-leg derrick in the quarry, a Brown hoist crane with a 30-ft. boom and an Industrial crane with a 50-ft. boom to handle large rocks; 102 flat cars equipped with aprons which are kept in service for the handling of stone or ballast, together with a right-hand and a left-hand plow and a Lidgerwood for unloading ballast or rip-rap.

The working force consists of 75 quarry laborers, 2 complete shovel crews, an extra gang of 20 to 30 track-

Heavy Coating of Salt on the Piles in Winter Time

men stationed at Lakeside, and a second extra gang of about 29 men with headquarters at Saline.

As a measure of preparation for storm trouble, it is the practice to have approximately 5,000 carloads of rock shot down in readiness for loading, in addition to some 20 or more carloads with rock on storage track at Lakeside, and an equal number at Promontory and at Little Mountain. With this organization and equipment it has been possible to maintain the embankment in condition to handle traffic with a minimum of interruption. Although serious difficulty has been encountered with the embankments at times as a result of storms, the trestle has given no trouble from this cause.

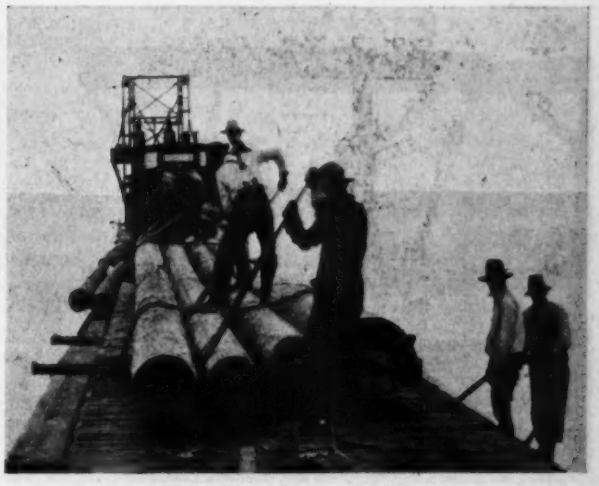
Piles Still in Excellent Condition

The careful inspection of the piles in the Salt Lake trestle has failed to disclose any signs of deterioration whatever, and indications are that an almost unlimited life may be expected of them. Inspection of the deck in 1918, however, disclosed a condition which called for extensive renewal. The plank was found generally decayed. The stringers were in much better condition, being rotted only at spots where the deck planks were decayed entirely through. Surface decay of the planking did not affect the stringers beneath. However, owing to the expense of removing the ballast and renewing the planking under traffic, and the fact that about 20 per cent of the stringers were in a condition requiring replacement, it was decided to renew the deck entirely and use the good second-hand stringers for other purposes.

At the time that this conclusion was reached it would have been possible to defer the renewal work safely for about three years and then institute operations on a scale that would insure the completion of the work by 1924, but after a thorough study of the problem it was concluded that more economical results would be obtained by beginning sooner so that a smaller organization could be employed for a longer period. Accordingly the renewal operations were started in December, 1920.

Owing to the heavy traffic over the trestle in the summer, it was found desirable to carry on the renewal of the deck only in the wintertime, when freight trains can be kept off the structure during an interval of five hours between regular passenger trains and give the bridge forces the uninterrupted use of the structure for that length of time. The regular schedule of the work provided for the employment of two bridge gangs with camps at Lakeside and Saline, respectively.

It was decided to renew the planking with redwood lumber, which has a long life, and to cover the stringers with a sheathing of one-ply roofing before placing the plank. This is expected to increase the life of the deck considerably. As an additional preservative measure the new stringers are soaked in the water of the lake as long as possible before using them. The stringers take up a considerable amount of salt, especially in the outer quarter inch. Tests showed that as much as four pounds of



Unloading the Brace Piles

salt per cubic foot of timber was absorbed in this ¼-in. thickness of timber in 180 days.

How the Work Is Done

The first step in the work as carried out, calls for the removal of the planking, which are pried off, allowing the ballast to spill into the lake, the track being blocked up on the stringers. The next step is to remove the old stringers, which is a difficult operation because of the trouble encountered in removing the drift bolts, which connect them to the caps. For this work an interesting jacking rig was developed as shown in the sketch. A piece of rail 4 ft. long is supported on two 15-ton jacks. Over this rail is hung a wrought iron yoke which reaches down to the top of the stringer, this yoke being provided with holes in its sides so that a steel bar may be passed through them, and also through a special square ring with a slotted hole in the bottom, something like the slot in a

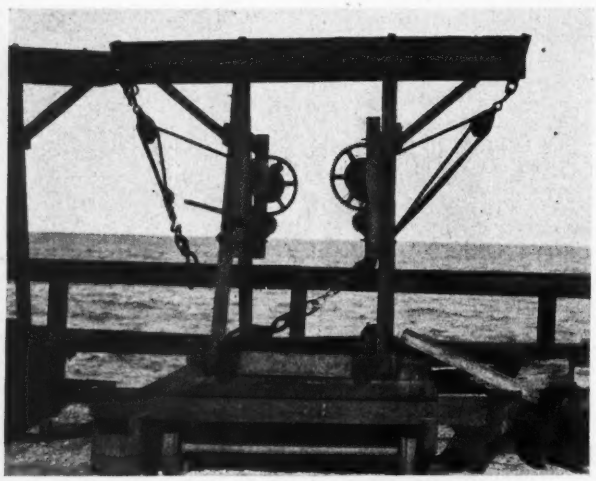
clawbar, that can be passed over the head of the drift bolt after the stringer has been notched down to make the head project. Several blows with a hammer sets the head of the bolt fast in the notch after which the bolt may be lifted out by jacking.

The stringers are handled with the aid of small hand derricks mounted on push cars and equipped with two manilla rope falls, operated by hand crabs. In cases where the outside stringers were found to be in a sound condition they were left in the structure as no difficulty will be experienced in renewing these outside stringers at any time without disturbing the deck plank.

Each bridge gang consists of from 30 to 32 men, the organization following the general plan outlined below:

6 men taking up the plank and dropping the ballast.
6 men pulling drift bolts.
5 men handling the stringers with the machine.
4 men blocking the track.
4 men bringing up plank.
2 men laying plank.
2 men putting on the paper sheathing.
1 man applying the asphalt, which was applied in a coating that called for one pound of asphalt to the square foot.

The track is blocked up on the newly completed deck to permit the passage of trains and the new ballast is applied by the extra gang track forces. Signal wires are normally carried on top of the hand railing along one side of the bridge and when the railing is removed these are placed in a 1,000-ft. length of trunking on the ties along the center of the track. The average progress for one gang at this work is about 75 ft. per day. The



The Hand Derrick Used in Erecting the Stringers

material for the deck renewal is kept in storage at Lakeside and is delivered on the trestle by work trains. About 75 per cent of the drift bolts removed from the old trestle are re-used.

Brace Piles Introduced

Another problem arising in connection with the maintenance of this trestle is an indirect result of the standard operating arrangement under which eastbound freight trains are required to take the siding for westbound trains. The application of brakes incident to the stopping of these trains on the trestle has had a tendency to move the deck eastward and to cause the piles in the vicinity of passing tracks to lean in that direction. This action is accounted for by the fact that the trestle contains no longitudinal bracing, it having been deemed inadvisable to apply such bracing because of the fear that this would introduce an obstruction to the wave action in the course of storms that might have the effect of throwing the trestle out of line.

To overcome this tendency of the trestle to move eastwardly, about 15 per cent of the bents have been stiffened by the addition of brace piles driven at a batter of three inches to the foot in a plane parallel to the structure and securely anchored against the two outside piles of the bent. To avoid interference with trains, these piles were

The Brace Piles Were Securely Anchored to the Batter Piles of the Bents

driven with a special gallows frame pile driver, this work being described in an article appearing in the *Railway Maintenance Engineer*, for August, 1918, page 261. In some cases this work has been conducted jointly with the renewal of the deck, particularly on the double-track sections of the trestle where it was desired to place the brace piling on the center line between tracks.

The maintenance of the Salt Lake trestle, and the renewal of decks and the application of brace piling has been carried on by the division forces of the Southern Pacific, under the direction of Otis Weeks, division engineer, Ogden, Utah, and under the general supervision of George W. Rear, engineer of bridges, Southern Pacific, Pacific System, San Francisco, Cal. F. W. Easton, roadmaster, is responsible for the maintenance of the embankment.

How to Distinguish Douglas Fir

IN TECHNICAL Note No. 198 the United States Forest Products Laboratory, Madison, Wis., offers information to assist in distinguishing Douglas fir from other structural woods of similar appearance.

Douglas fir is a resinous wood, with a characteristic sweetish odor. Exudations of resin on end and side surfaces and pitch pockets are common. Occasionally pitch streaks occur. The sapwood, which is from 1 to 3 in. wide, is white. The freshly cut heartwood is light reddish yellow in color. On exposure to light and air it becomes distinctly reddish, sometimes cherry red, or reddish brown, except the outer portion of old trees which often remains light reddish yellow, which explains why the wood is sometimes known as yellow fir. The summerwood is pronounced, except in very narrow rings such as usually occur in the outer portion of old trees.

In southern yellow pines, Norway pine and western yellow pine, the heartwood is less reddish and more orange brown. There is a characteristic pine pitch odor. On planed surfaces the resin ducts often are pronounced as brownish lines running parallel to the grain, whereas in Douglas fir the resin ducts are obscure.

How Maintenance Men Can Help Handle the Peak Load Traffic

Further Contributions in the Contest on the Responsibility of this Department in the Moving of the Heavy Business

THE TWO prize winning articles and three other contributions received in the contest on "Ways in Which the Maintenance Department Can Assist in Handling the Peak Load Traffic" were published in *Railway Engineering and Maintenance* for September. Eight other articles were received in this contest which contain ideas and information which warrant careful study by maintenance officers. These papers are presented in abstract below:

Avoiding Delays to Trains

By E. M. GRIME,
Supervisor of Bridges and Buildings, Northern Pacific, Fargo, N. D.

While the most essential elements in the work of handling a peak load traffic are loyalty to the best interests of the company on the part of all employees and active co-operation between the maintenance of way and operating departments, it is also important that the maintenance officer should apply his loyalty and willingness to co-operate along practical lines if he is going to contribute to the fullest degree. It is assumed that the condition of a peak load in the fall has been anticipated by all concerned and that the maintenance of way department, as far as practicable, has already cleaned up its major items of work such as important bridge work, rail laying, ballasting, ditching, etc., but where this has not been possible, the only thing to be done now is for this department to bear in mind at all times that the railroad is maintained to carry revenue-producing freight and that its work must be continued in the way that will interfere least with efficient operation.

If rail laying or ballasting is still in progress it is up to the foreman to watch more carefully the line-up of trains as secured from the dispatcher and see that everything is in readiness to make a closure well in advance of each train or to maintain his ballast run-off in safe condition at all times so that he can immediately signal every approaching train to come ahead.

The slow orders in effect on the division should be scrutinized daily to make sure that none remains longer than absolutely necessary. In many cases where culverts are being placed under main tracks it will be best to put in a temporary bridge in order to maintain the track in proper condition rather than to put on a slow order. In bridge work, methods should be followed which, while sometimes slightly more expensive, will reduce to the fullest extent, the necessity for slow orders. The bridge foreman, if not located close to a station, should have a portable telephone at the site of the work so that he can keep in touch with the dispatcher at all times and thus handle his work between trains so that there may be no interference with regular traffic. When small amounts of materials are to be delivered to the work on the way freights, arrangements should be made in advance with the chief dispatcher so that they can be handled on the day when the freight has the least regular work to do.

Surplus bridge material to be loaded, while usually conveniently done with a pile driver line or derrick car and work train, may often be piled up on a skid alongside the track where it can be quickly transferred to a flat car with little delay to the local freight. Small quantities of bridge timber may be unloaded at the nearest station and moved out to the work by means of a motor car or old material may be moved into the station by motor car and there loaded ready to be picked up when the way freight is doing regular station work. By watching the invoices received and anticipating the arrival of material, arrangements may often be made to unload it with a work train used with a pile driver or for other work and thus avoid delaying regular trains with this class of work.

The maintenance officer must always anticipate his work weeks or months in advance and plan to carry it on in a regular and orderly manner with the least shifting of work crews and interference with traffic. At this time, therefore, he must redouble his efforts along this line and keep in the closest touch with those directly responsible for the operation of trains so that his department will at no time be the cause of unnecessary delays.

How the Foreman Can Help the Other Departments

By JAMES SWEENEY,
Supervisor, Chicago & Eastern Illinois, Danville, Ill.

It is not so much a question of what will happen when car loadings reach the expected peak in the late fall, as it is what we are doing right now when car loadings are already heavy. The various departments have met their problems in a manner that reflects credit on them. Time freight movements have again become a reality rather than a memory, bad orders have been cut down, terminal delays have been reduced and now the departments which have accomplished these things begin to look at the man on the track as much as to say, "Well, Jerry, we've done our bit toward making this a railroad, now what are you going to do?"

The natural thing for Jerry to say would be that he had built a railroad and if the high-powered, high-geared operating department couldn't run it that would be "their funeral." However, this is not the attitude of the average section man. He can do more growling to the square inch than any man I know when he is called off his track to do some neighborly turn, yet, like most good neighbors, he is secretly quite proud of the fact that he is called. In that very thing, in my opinion, is the great opportunity of the section man to help keep traffic moving—not in any great campaign of torch carrying and horn blowing, but in being on the job to give a little help here and there when it is needed. There are none too many men in any section gang at any point but the foreman who wants to "railroad" will always spare a man for a time to do almost anything.

If a car is set out "account bad order" and a car repairer comes to make repairs, a section man can often provide just the help necessary to get the work done and save a day's delay. I have known section men to hunt up odd pieces of tin and patch a car roof so that it

could be loaded, a foreman, who knew something of gas engines from tinkering with a Ford and a motor car, to fix the engine at a country elevator, so that it worked all day and two cars moved out loaded that night.

It is not what they do that counts, but the fact that they make it known to the members of every other department that they are willing to do anything to make the railroad run. That, after all, is what we mean when we talk of keeping traffic moving.

Often the foreman has certain definite conditions to meet and the way he assigns his work may mean the saving of many car days. One foreman I know has assigned one man to keeping things moving in a freight house yard. The freight agent looks to him for all rush work, and he is in reality a one-man section gang with the regular gang available if needed. It is hardly necessary to say that much of his work is not track work, in the strictest sense, but it is railroad work.

In advocating co-operation on the part of the section men with the other departments, I do not mean that they should allow everyone who thinks he needs help to take them away from their own work. Many a foreman has failed to make good as a foreman through being too good a neighbor, but there is a happy medium and the high grade foreman can be depended upon to find it.

Keeping Down Derailments Will Help

By E. D. Swift,
Engineer Maintenance of Way, Belt Railway of Chicago, Chicago.

That there is a very vital relationship between the physical condition of a railroad property and its ability to handle its business effectively is evident, but, given facilities of a definite character and a standard of maintenance which is normal to the situation, the opportunities of the average maintenance of way organization to speed up the movement of traffic, for that is what it amounts to, may not be so clear.

Probably the best way to approach this problem is to make a survey of those conditions or circumstances which retard traffic, particularly those features of operation which, in some measure or other, are under the influence or observation of the men doing maintenance work. Presumably, the ways in which maintenance men can help will differ in many respects as to location and operating characteristics, but there are probably some kinds of obstructions which are common to most situations. I have in mind one from which all railroads suffer more or less. I refer to derailments.

The causes for derailments may be grouped under three heads, equipment failures, track failures, and man failures. In the latter category I place such accidents as have a cause in the careless or faulty movements of cars or engines. It is probable that the maintenance man cannot do much in eliminating accidents of this nature, but opportunities do come to him to guard against derailments caused by track and equipment defects.

Owing to the multiplicity of parts and the intricacy of design of track materials used in important yards and terminals, it is of first importance that such tracks should have the careful inspection and supervision of smart trackmen. Apparently minor defects, which might well escape the attention of an indifferent or inexperienced man, may easily be the cause of troublesome and costly derailments. Suffice it is to say that the old adage, "a stitch in time saves nine," has no more direct application than in this work.

In this day when every car, which can carry a load, is being used, many are running which have seen their best days. The failure of some piece of equipment in transit is a common occurrence, and brake equipment which has become unfastened is a frequent cause for derailment. This is particularly true in and about yards and terminals, and also through interlockers where switches, derails and other track fixtures offer means for catching equipment which is dragging. Co-operation between train and locomotive service employees and the maintenance of way department can do much to reduce the liability of such derailments. This can be done by giving maintenance of way men instructions to scrutinize passing trains for unfastened equipment and by having the train and engine men keep an eye open for signals from the maintenance men who have noticed defective conditions which endanger the safety of the trains operated over the line.

Close Supervision Is Essential

By J. P. Corcoran,
Roadmaster, Chicago & Alton, Bloomington, Ill.

The maintenance of way department can materially assist the transportation department by keeping down slow orders and, in the case of surfacing and rail laying, by limiting the length of track covered to the portion on which the work is being done. Slow orders should be arranged carefully by the roadmaster and supervisors to see that they are removed as soon as work is done. Slow orders on the line should be checked up every day by either the roadmaster or the supervisor. If an order should be placed on any portion of the track during the night, the chief dispatcher should notify the supervisor concerned as soon as the order is sent out. This gives him a chance to make prompt repairs and have the slow order removed as soon as possible the following day. A record of slow orders sent supervisors and roadmasters once a week for checking insures that no orders are carried over that are not actually necessary.

The telephone is one of the greatest aids on the railroad in the handling of extra gangs in either ballasting or rail laying work. The timekeeper can keep in touch with the dispatcher, who advises him at what time a train will be at a point where the extra gang is working. This enables the extra gang foreman to close up his rail laying and be ready for the train, or, to have his run-off made in ballasting. In both cases the extra gang is kept working at tightening bolts, driving spikes, etc., while the ballast gang can tamp the inside of the track while waiting for the approaching train.

All cars, whether box, coal or flat cars, that are loaded in the maintenance of way department should be unloaded as promptly as they reach their destination. This can be done where the material is loaded by the store's department, if the roadmaster or supervisor is notified the day of the loading and he in turn confers with the trainmaster and chief dispatcher regarding the prompt handling of cars to be released by the local train as soon as they arrive. The supervisor can then make arrangements with the section foreman to meet the train and unload the material if it is to be unloaded out on the line, or if the car is placed in a yard he can see that it is either released in the evening when the foreman returns from his work or the first thing the next morning. I have found it very helpful to have the section foreman wire the supervisor each night of any car under load at his station and what it contains, so that the supervisor may make arrangements that evening for the prompt release of the car the following morning.

During the present year the unloading of 400 cars of track ties was handled by local trains without holding

any car over two days. This was done by having the supervisor keep in close touch with the trainmaster and the chief dispatcher.

Another great source of delays to trains is the condition of main track switches, frogs, guard rails and turnouts leading to passing tracks or heavy switching yards. These should be examined daily to see that they are in first class condition to avoid any derailments that might tie up trains and equipment but which could be avoided if the switches had been properly taken care of when they were examined by either the track walker or section foreman. A monthly switch and frog report based on weekly inspections by the section foremen, noting the condition of all turnouts, which report is checked over from month to month by the supervisor, will insure that work reported as needed in previous month has been taken care of.

Study Work Train Requirements

By JOHN EVANS,
Division Engineer, Michigan Central, Detroit, Mich.

The elimination of work train service wherever possible and the thoughtful planning and close supervision of such work train service as is necessary accrues to the advantage of both the maintenance of way and the transportation departments. Work train service is expensive at all times. A large proportion of the time paid for is spent in getting to and from terminals and in waiting in sidings for revenue trains to pass. This lost time is particularly large when the revenue business being handled is abnormally heavy. During the delays the pay of the train crews and the maintenance of way men assigned to the train, goes on just the same as if they actually worked., and all the time that the train is out the engines, cars and train crew in use on the work train are unavailable for revenue service.

Looking after work trains makes it necessary for maintenance of way supervisory forces to neglect their other duties more or less. When work train service is being planned for any purpose, except the handling of large amounts or rail or ballast, careful study may possibly show that the work contemplated can be handled partly or entirely without it.

While local freights and switch engines usually have difficulty in taking care of the normal day's work assigned them, operating officers will usually try to give some help from these sources, when this will eliminate a work train. Maintenance men may lose some time in waiting to meet these local freights, but there would probably be just as serious loss of time to them with a work train.

By the use of teams or trucks work trains can sometimes be avoided. Recently when it was necessary to unload a rather large amount of filling material at a number of main track highway crossings, it was found to be cheaper and quicker to place the cars of filling material on the nearest team tracks, and haul the material to the crossings in trucks, than to unload it directly on the crossing with a work train.

An attempt should be made to plan the entire day's work for the work train on as short a stretch of road as possible. The moving of the train between points considerable distances apart during the day is a common mistake and results in a large proportion of waste time. The hauling of one or two cars between distant stations is often done by such trains when it could be done by local freights.

It should be borne in mind that the expediting of work train service lessens the cost of the service, helps the operation of the railroad by the earlier elimination of delays to other trains and the earlier release of the work train engine, cars and crews to revenue service, and helps the maintenance of way department through the earlier return of its forces to their regular duties.

Give Slow Orders Proper Attention

By J. J. HESS,
General Roadmaster, Great Northern, Seattle, Wash.

Of course, if all extraordinary work could be gotten out of the way so that nothing remained but ordinary repairs, there would be little or no cause for delays of trains due to interference by the roadway department. However, there are many reasons why this cannot be done, particularly in the northwest where the season is short. Many things can be done to prevent delays, as for instance to avoid restricting speed more than is absolutely necessary and to make every effort to complete repairs promptly so that trains can resume normal speed, also to see that slow orders are cancelled immediately after the repairs are completed.

Delays can also be avoided by the removal of slow or caution signals on account of work, at all times except during working hours. It often happens that they are left displayed throughout the entire day and night although the nature of the work only requires their observance during working hours.

Temporary repairs to block signals can often be made by roadway men. When not, it is well for them, to insure that the cause is not some track defect and then notify the superintendent so that a "disregard order" can be issued and the signal maintainer advised. Switch lights should also be watched closely and kept in good repair so as to remain lighted. It is also a great help to permit foremen, if close at hand, to close switches upon the departure of trains, thereby saving delays, the liability of pulling out drawbars, etc., by not having to stop. Pains should also be taken to see that speed restrictions as well as schedule speed is strictly observed and that in any cases of violation, that the persons at fault be notified by word of mouth in place of a formal report. Train and engine men are glad to have their attention called to these things and will usually exercise more care in the future.

Everything possible should be done to avoid stopping trains. Trackmen do not always realize how much it means to stop a train. It can often be avoided by tamping every other tie, if need be, in surfacing track or by having enough spikes driven when changing out or laying rails to make the track safe at reduced speed. Nearly all work can be speeded up so as to avoid compelling trains to come to a full stop. Delays can also be avoided by seeing that fences and cattle guards are kept in good repair so that stock does not interfere with trains.

The Season's Work Should Be Started Early

By F. LISTON,
Canadian Pacific, Vandreuil Station, Quebec.

In the study of conditions that would warrant the undertaking of any improvements to roadway or structures due consideration should be given to the complexity of the traffic situation, and operations should be opened early enough to permit of their completion without offering obstructions to the handling of the anticipated peak load traffic. This can be brought about by assembling the required equipment and tools at points where the improvements are to be made so that, with an early delivery

of the necessary material, the work can be commenced at the earliest possible date and pursued systemically and with the utmost vigor so that all transportation equipment will be released as early as possible for the ever rising contingencies that tend to disrupt programs of car allotments for the peak load traffic.

The releasement of this equipment; viz., engines, cars, and the necessary crews to man them, can be expedited greatly if the maintenance of way departments used the various labor saving devices which tend not only to speed up the work but also reduce to a minimum the labor required in the performance of many operations. Among the various labor saving devices which I have seen in operation and which appeal to me forcibly are the unloading bars and hooks used on the Canadian Pacific. The bar and hooks are of a very simple and inexpensive construction and permit the unloading of an average of 50 cars of rail in the same period of time that it ordinarily takes to unload 10 or 15 cars under the ordinary methods. In addition the rails suffer no shock, being deposited gently at the ends of the ties instead of being dropped haphazard and trusting to luck that their final resting place will be the base of the ballast section and not the toe of the embankment.

The general maintenance work, which is usually pursued vigorously after the tie renewals are completed, should be advanced far enough to give smooth riding track, for track in good surface, line and guage offers less resistance to the hauling of trains, minimizes deterioration to the rolling stock and permits the elimination of all slow orders on account of faulty track.

In addition to the correction of any defects that might be found in the daily track patrol, particular attention should be given to the close scrutiny of the equipment of all passing trains. Coupled to these duties, track forces should never falter in giving the traveling car repairer a helping hand in effecting immediate repairs to a car that was set out of a train so that it may be forwarded to destination with the least possible delay, finally should it be necessary to ship O. C. S. material in carload lots the cars should be released immediately. Operations such as these tend to help the track forces share in the laurels won through a successful peak load movement.

Tell the Foreman What Is Wanted

By G. S. Crites,
Division Engineer, Baltimore & Ohio, Baltimore, Md.

Team work is required to put across this fall's peak load traffic. To get the team spirit the entire personnel of the division must know the objective to be reached. The maintenance of way department is an important part of the team and as such must know the position it plays. On the Baltimore division of the Baltimore & Ohio the "signals" are passed right down the line to the men on the ground. Supervisors call meetings of their foremen and the superintendent and division engineer with a trainmaster and road foreman of engines, or their assistants, attends and go into details as to the work ahead.

It is explained that transportation is what we sell and that the welfare of our railroad as a going concern and of our nation as a good place to live is dependent upon our efforts in transporting the traffic offered. The prime duty of the maintenance man is to see that the property in his keeping is safe for the passage of trains at schedule speeds at all times, but he can help to speed up traffic in other ways.

At stations he can often give a hand in unloading freight at the platform and save a car day. He can note the cars on blind sidings and advise the assistant trainmaster, agent or local car man, or, if necessary, wire the superintendent of unusual delays and what is needed to get the car moving.

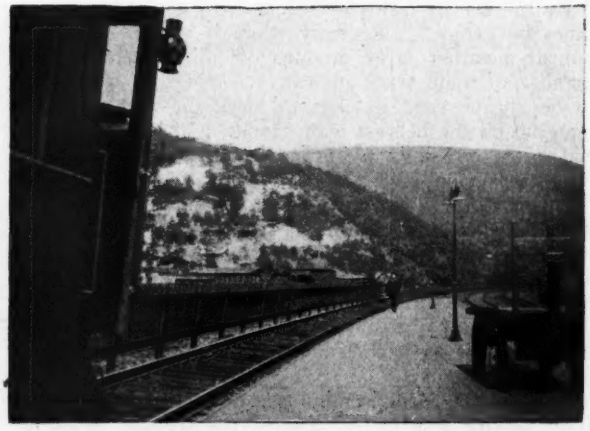
He can watch car loading and see that cars are loaded to capacity and that shipments are so loaded that they may be unloaded in rotation as they move over the road, if the load is to be distributed at more than one point. Often he can advise isolated shippers of the need of full and prompt loading of cars and call the proper officer's attention to any misuse of cars coming to his attention as he goes over the line.

He should watch passing equipment carefully and signal train or engineman of hot boxes, broken or dragging equipment or shifting loads. Where speeds are scheduled he can check passing trains and notify proper authorities of any fast running.

When the road is obstructed or liable to be obstructed the foreman, as the man on the ground, should quickly transmit full details in order that complete and quick arrangements may be made to open the line or prevent it being closed. The men on the ground are told the details of arrangements made for opening up the line when obstructed and the information which they must furnish.

The maintenance work on the division is programmed and the men on the ground are given their part of the program and it is explained that the part of the program that calls for the use of cars and work trains must be given preferred attention. Station and plant coal is to be gotten on the ground for fall and winter use. In storing engine coal two parallel tracks are constructed of the proper length and spacing. Coal is dropped and plowed off, and while it is being dragged on one track, a locomotive crane lifts the other track. After the coal is stored the tracks are thrown off the coal piles and located for the prompt loading of the coal thus stored by steam shovel operation.

The main point is to get maintenance work programmed and officers and men familiar with and fully behind the schedules outlined. By having transportation and maintenance men get together and talk over the objective to be obtained, it is found that transportation men become familiar with the problems of maintenance and can help in many ways in distributing materials and in reducing delays to work trains. The maintenance men get a broader view of the game they are playing and feel that the prompt movement of cars is as much their business as the proper maintenance of the properties is their care. Team work is the slogan.



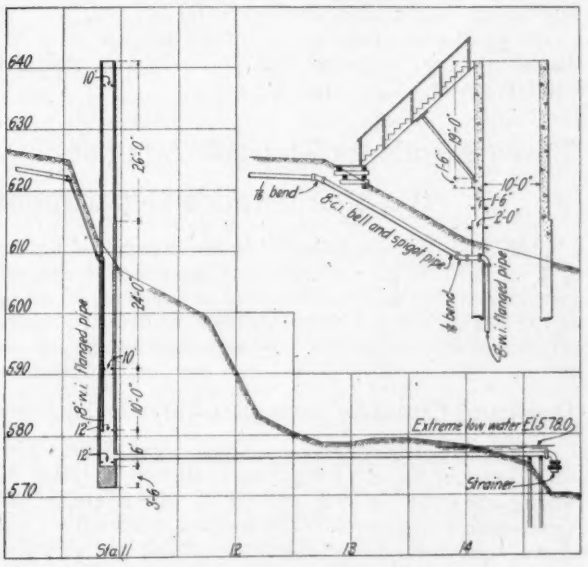
The Fence Between Tracks Is an Important Safeguard

Pumping Water from a Stream with a Sixty Foot Stage Variation

Motor Driven Centrifugal Units Feature Novel Installation of Great Northern on Columbia River

BY ROBERT HERZOG
Assistant Engineer, Great Northern, Seattle, Wash.

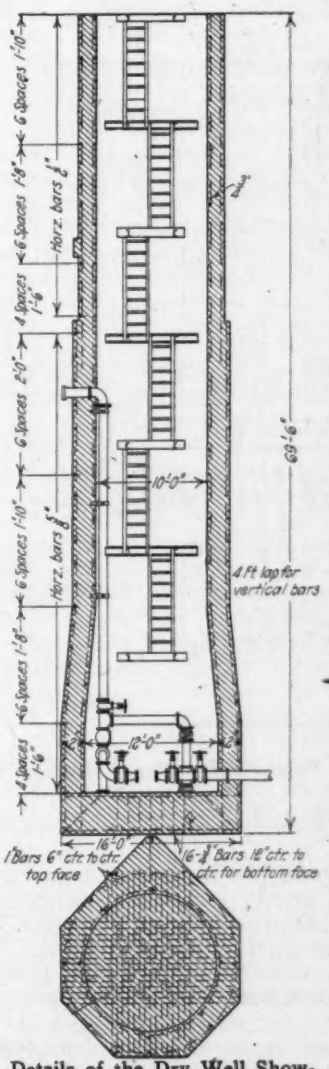
THE Great Northern terminal at Appleyard, near Wenatchee, Wash., derives its water supply from Columbia river, which at this point has a range of more than sixty feet between extreme high and low water. As this terminal is an important one, especially during the fall when a large number of fruit trains are made up here and moved east at short intervals, an abundant and reliable water supply is a prime necessity. To provide this supply presented a problem, not alone involving the variation in level, but also the destructive character of the river in flood seasons for any exposed works, and the considerable region subject to flooding, the river spreading about 850 ft. inland at high water.



A Condensed Profile of River Bank and Pipe Line

The problem was met by installing direct-connected motor-driven centrifugal pumps in duplicate in a dry well near the river bank. They are located a sufficient distance below extreme low water level to be always primed and are automatically controlled by the desired elevations of the water surfaces in the 100,000 gal. elevated tank, a quarter mile distant from the river. The desire for simplicity in construction and compactness were factors in the selection of centrifugal pumps.

The excavation for the dry well, which is a reinforced concrete structure, was made in open cut to within 16 ft. of the bottom, the material consisting largely of glacial deposit quite difficult to work in spots. For the remaining 16 ft. which was through water-bearing sand and gravel, Wakefield sheet piling were driven, this piling consisting of three rows of 2-in. planks. The bearing quality of the soil was tested, and found to be capable of supporting 2¼ tons per sq. ft. A layer of concrete one foot thick, troweled smooth on the top, was deposited at the bottom of the excavation. This was covered with two thicknesses of asphalt-saturated paper which was heavily coated on each side with petrolastic paint and carried up on the inside of the outside concrete form to a height of 20 ft. above the bottom. A 3-ft. 6-in. bottom slab heavily designed as a beam and reinforced against a computed uplift pressure of 940,000 lbs. or 4,218 lb. per sq. ft. created by the maximum hydrostatic head of 67.5 fet., was then poured, after which the barrel of the well was completed.



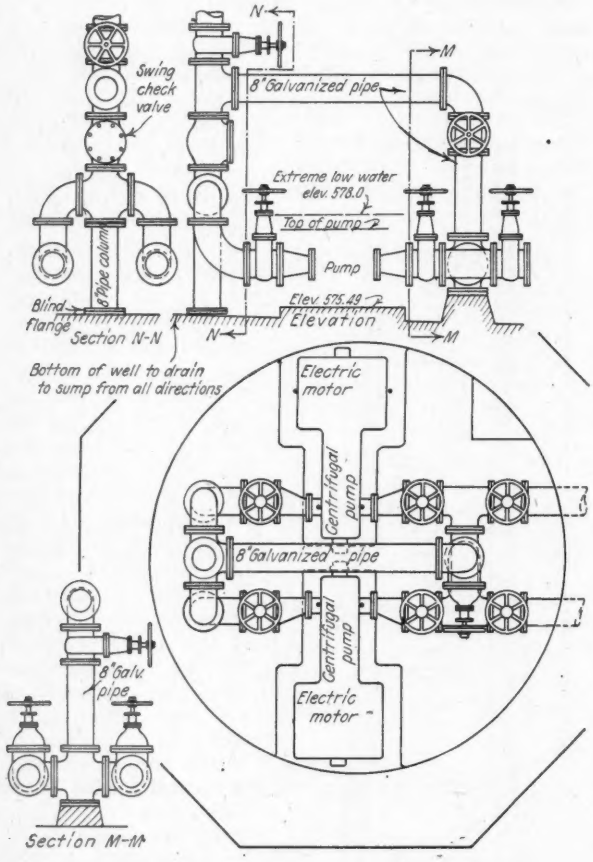
Details of the Dry Well Showing the Stairways

This barrel is circular inside and octagonal outside, except that instead of being a perfect octagon, there are but two faces on the upstream side which converge to form a plow shaped face, thus providing a breakwater and permitting the insertion of reinforcement at a greater distance from the center of the well to assist in carrying the stresses produced by the force of the high water. The well is 12 ft. in diameter in the bottom six feet. A conical section 10 ft. high, then brings the diamenter down to 10 ft., after which the wall extends vertically to the top. The barrel is 2 ft. thick, except for the top 26 ft., which is 8 in. thick. In this barrel are two joints, one at the top of the cone and one where the wall changes from 2 ft. to 18 in. in thickness. Each joint is provided with a 6-in. galvanized metal tongue, forming a complete ring in the center of the concrete wall.

The reinforcing consists of ¾-in. vertical bars placed next to the inside face of the barrel at the ⅛ points, and another set next to the outside face at the 1/16 points, with outside and inside horizontal bars of ⅝-in. iron, except in the upper 26 ft., where ½-in. bars are used. The spacing of the horizontal bars ranges from 29 in.

at the bottom of the well to 24 in. at the top.

The two galvanized suction pipes from the well to the intake, each eight inches in diameter, were laid in an open trench, the outer two-thirds of which had to be supported by cofferdams in lengths of 30 ft. as the grade of the pipe is from 2 ft. to 12 ft. below the surface of the water at low level. The arrangement of the pumping units is shown on the drawings from which it will be noticed that the suction pipes are cross-connected so that either or both may serve either of the two pumps. Flush or by-pass lines consisting of 8-in. galvanized pipe connecting the discharge and suction lines, allow



Plan Showing the Duplicate Pumping Layout

the suction pipes to be flushed by a full head of water from the elevated tank.

The equipment consists of four-inch single-stage double suction centrifugal pumps, each direct connected through a flexible coupling to a 40 h. p., 1750 rpm. 3 phase, 60 cycle, 2200 volt alternating current motor. A small automatic vertical motor-driven centrifugal pump takes care of any water that leaks from the large pumping units.

The pumps are reached by six flights of stairs connecting with commodious landings located on alternate sides of the barrel. These landings and the stairs are carried on channel irons fixed in the wall. This system of stairs terminates at a point 12 ft. above the bottom of the well from which the pumps are reached by a series of rungs anchored in the wall.

The automatic control of the main units by a float switch provides for stopping and starting the motor-operated pumps as soon as the water tank has been filled or drained to the desired elevation. As a precaution against the failure of the pump to start when the tank has been drained to the allowable level, a second float switch is installed for the control of an audible alarm in the roundhouse which causes the ringing of an alarm signal as soon as the water surface in the tank has fallen a certain distance below the allowable elevation. To start and stop, push buttons are located in the roundhouse.

The work on the well was commenced in November, 1922, and water was delivered to the elevated tank on April 24, 1923. Two tests have been run to determine the capacity and the efficiency of the plant under different heads. Under the first test made on April 24, the pump delivered 619 gal. per min. against a combined static and friction head of 145 ft. with a pump efficiency of 72 per cent. Under the second test on May 17, the pump delivered 788 gal. per min. against a total head of 126 ft. with an efficiency of 68 per cent. The elevation of the water in the Columbia river on May 21 was 21 ft. above the floor of the well and rising at the rate of 0.6 ft. per day, but no indications of water filtering through the walls could be detected. The concrete was a 1:2:3½ mix, with 10 per cent of hydrated lime added and a petrolastic coating applied to the outside.

The work was carried out under the direction of A. H. Hogeland, chief engineer, and O. S. Bowen, assistant chief engineer.

Three Accidents Charged Against the Maintenance Department

AMONG the reports issued by the Bureau of Safety of the Interstate Commerce Commission during recent weeks, covering investigations of accidents resulting in the loss of life, are three attributed to defective maintenance of way conditions. These reports are abstracted below.

Derailment Caused by Inadequate Curve Maintenance

A southbound passenger train was derailed near Linton, Kan., on the St. Louis-San Francisco on June 28, killing one employee and injuring 27 passengers, 3 mail clerks and 4 employees. The accident occurred on a 2 deg. 2 min. curve to the right, the outside rail of which was elevated 3½ in. The track was laid with 85-lb rails, single spiked to about 20 ties to the 33 ft. rail on 12 in. of chat ballast. About 80 per cent of the ties were untreated white oak and the remainder creosoted hardwood, all without tie plates. An examination of the track following the accident indicated outward lateral wear of the rails on the top of the ties ranging from ⅜ in. to 1⅛ in.

In a report to the Interstate Commerce Commission, the director of safety states that "apparently as the engine rounded the curve at a high rate of speed a severe side thrust was exerted on the outside rail, causing this rail to cant outward, allowing some of the engine wheels to drop on the gage side of the east rail, the wheel treads running on the flange of the base of this rail, and the edge of the wheel rims marking the web, while the opposite wheels remained in normal position on the west rail. An investigation of track conditions in the vicinity of the point of the accident disclosed ties installed without being spiked, spikes with broken heads, numerous loose spikes, and also spikes that had been forced backward from their original positions, coupled with lateral wear on the tops of the ties under the base of the east rail in the immediate vicinity of the point of derailment,

which conditions probably account for the overturning of the rail under the engine moving at high speed."

Train Derailed by Land Slide

On July 5 an Oregon-Washington Railroad & Navigation Company passenger train struck a landslide and was derailed while running over the tracks of the Northern Pacific (which it uses under trackage rights) near Tacoma, Wash., resulting in the death of one employee and the injury of 15 passengers and two employees. The tracks at the point of derailment and for several miles in either direction are parallel to and about 20 ft. above the level of Puget Sound, with bluffs approximately 175 ft. high on the opposite side. The train, which consisted of two baggage cars, three coaches and six Pullman sleeping cars, was traveling at about 35 miles an hour when a slide of about 210 cu. yd. came down directly in front of the engine and not more than 20 ft. in advance of it, covering the track to a depth of about three feet.

The formation of the sides of the bluff and cuts in this vicinity consists of a top layer of loose gravel, a stratum of sand and a sub-soil of clay and hardpan. The roadmaster stated that near the point of the accident the bluff contained springs in all of its formations and that rains often caused the sand to be washed from under the gravel, resulting in a sloughing off of the face of the cuts. A drainage ditch 15 ft. wide is maintained on the inside of the track next to the bluff and a ditching crew is employed throughout the year to maintain this ditch. A patrolman is also employed during the rainy season, but as the weather had been dry during the preceding two month his services had been dispensed with.

Within the mile in which the accident occurred five concrete culverts, three timber culverts and one box culvert extend under the track, three being located in front of the slide. Within this same mile 15 small streams drain from side cuts into the ditch, these streams being fed by underground springs. Even though less than one-half inch of rain had fallen within a period of 30 days preceding the accident, enough water was escaping from these side cuts to feed the 15 small streams, a condition which gives weight to a theory advanced that a water pocket had formed and undermined the top strata of gravel and sand which slid down the face of the cut under the tracks. The geologist of the Oregon Bureau of Mines is quoted in the report of the Director of Safety of the Interstate Commerce Commission as being of the opinion that the character of formation of the land in this vicinity is such as to warrant a thorough investigation of the sources of the water now draining from the bluffs and the control of its flow through conduits so that slides of this nature may be controlled.

Passenger Train Wrecked by Poor Track

A special passenger train of nine cars on the Grand Trunk Western line was derailed near Durand, Mich., on June 5, while traveling at a speed of 50 miles an hour, resulting in the death of five persons and the injury of 27. The accident occurred on tangent track laid with 80 lb. rails, 28 ft. long, supported on an average of 16 oak, white cedar and tamarack ties to the panel.

In the report of the director of the Bureau of Safety of the Interstate Commerce Commission, the statement is made that the track was poorly maintained and generally in poor condition. The ties were badly rail cut and many were broken and decayed. Within a half mile west of the point of the accident 143 broken and decayed ties were found in a 30-rail section, as many as 12 being found in one rail section. Numerous low joints had been shimmed up, nine ties being shimmed up at one rail joint with shims varying from ½ in. to 1¼ in. in thickness. Many loose spikes were also found. The track was originally ballasted with gravel more than 25 years ago, but the gravel had disintegrated and mixed with the dirt to such an extent that it is now practically of no greater value as ballast than natural soil. The report concludes with the statement that "In view of the condition of this track, the speed of trains should have been restricted, by slow orders or otherwise, to safe limits. The operating officers of this railway are responsible for permitting these conditions to exist and for allowing trains to be operated at speeds which are excessive in view of the existing track conditions. Steps should be taken immediately to restrict speeds within safe limits and to place this track in proper condition for the operation of trains over it."

Decisions of the Labor Board

THE following are excerpts from recent decisions of the Labor Board involving employees of the Maintenance of way department.

New Organizations Approved on Union Pacific

On February 5, the Union Pacific circularized its supervisory forces in the maintenance of way departments suggesting the organization of an independent association of foremen, assistant foremen, and bridge inspectors. The road sent a similar circular to the mechanics and helpers of the maintenance of way and bridge and building departments suggesting that they also form an organization independent of the other classes embraced by the Brotherhood of Maintenance of Way Employees and Railway Shop Laborers. These notices also included ballots by means of which the employees addressed could designate their wishes with respect to such new organization as a formality by which the organization could be set in motion. The general chairman of the United Brotherhood of Maintenance of Way Employees and Railway Shop Laborers objected to this action of the railroad, but the railroad continued its negotiations and asked that the Brotherhood participate in the ballot but the chairman declined to do this and contended that the entire action on the part of the railroad was irregular and not in accordance with the intent and spirit of the agreement and should therefore be considered null and void.

The opinion of the Labor Board in this case is, "that the maintenance of way foremen composes a separate distinct class of employees; that as such, they have the right to form an organization of their own or to secure representation through an organization comprising other employees, as they may prefer. That bridge and building mechanics and their helpers likewise constitute a distinct class of employees with the right to separate organization, has been heretofore decided by the Board. The Board is clearly of the opinion that these employees do constitute a distinct class and that it would be obviously unjust to permit the large element of track and shop laborers to legislate for skilled mechanics over their protests."

Erie Rebuked in a Contract Case

In a case involving the failure of the contracting firm engaged in maintenance of way work on the Erie to apply a two cent per hour increase to certain employees, provided in the Board's Decision, No. 1267, the railroad contended that the protest is against the contractor and not against the road, and that the jurisdiction of the Board under the statute does not extend to the employees of the contractor. The decision of the Board reiterates its previous decisions in contract cases and declares that the Erie has violated decision No. 1219 of the Board and

is willfully and knowingly persisting in such violation in contempt of the opinion expressed by the Board in that decision and in contravention of public welfare. Decision No. 1962.

Authorizes Reduced Wages on The Kansas City, Mexico & Orient

After a long series of negotiations, the Board has rendered a decision on the plea of the Kansas City, Mexico & Orient for a differential in wages below those paid to employees on other roads, because of the serious financial predicament in which this property has been for some time. The Board accordingly decided to restore the rates of pay in effect previous to March 1, 1920 for all employees of the road with the exception of train dispatchers, those covered by the telegraphers' agreement and a few others. In making this decision the Board referred to the controversy as follows:

"The Board is sympathetic with the principle that 'the ability of the carrier to pay' is not a controlling factor in fixing wages, but recognizes that it is entitled to secondary consideration with a certain type of carriers which are dependent almost entirely on local business, or whose principal function in the final analysis is the development and upbuilding of a new and comparatively new country. This decision is responsive to a local condition existing on this carrier which the Board hopes may be only temporary." Decision No. 1933.

The Cause of Transverse Fissures

IN a report on the formation of transverse fissures in steel rails submitted to the Interstate Commerce Commission and made public by it early in August, James E. Howard, engineer physicist of the commission, presented the results of a study of more than 8,000 transverse fissures on several roads. These rails represent the product of each of the rail mills of the country, together with the Algoma mill in Canada; they represent rails from each of the great steelmaking processes, Bessemer and open-hearth; rails from all parts of the ingot; and those of different weights up to the heaviest sections which are being rolled. In numbers they predominate on trunk lines of high speed, heavy equipment, and congested traffic, where the best conditions of maintenance prevail. They represent rails which were tested and accepted under specifications promulgated by the railroads.

The number of transverse fissures is greatest on those roads where the traffic is the heaviest. It appears that transverse fissures occur in larger numbers on the gage side of the head of the rail than over the web or in the outer half of the head. Furthermore, on curves the low rails display the larger number of fissures, while on double-track roads the rails carrying the heavier traffic are more affected by transverse fissures.

On the Harrisburg division of the Philadelphia & Reading, a partial enumeration shows 494 transverse fissures in rails in the eastbound or heavy tonnage track against 39 in the westbound track. On the New York Central there were 675 transverses fissures on the gage side of the head against 125 over the web, with a lesser number located in the outer half of the head. On the division between New York and Albany there were 136 transverse fissures in low rails of curves against 15 in high rails. The Lehigh Valley reported 487 transverse fissures located on the gage side of the head and one fissure on the outside; high rails, 34 fissures; low rails, 132 fissures.

The number of fractures is at a minimum during the summer months, with an upward trend in the fall and early winter months, a maximum being reached in the month of December. Transverse fissures being of progressive formation, their final stages of development may occur at any time. The length of time required for incipient fissures to make their presence known depends upon the amount and character of the traffic carried by the rails. The display of transverse fissures is not a matter depending upon the calendar month, nor whether the rail as a whole is exposed to ascending or descending temperatures. Track and traffic conditions are the governing factors.

There is a general feeling among engineers that uncertainties attaching to rail steel will manifest themselves most prominently in rails from the upper part of the ingot, notably in the A rails. Whatever superiority may attach to a rail from a particular part of the ingot, marked superiority is not shown in the suppression of transverse fissures. According to ingot letters, the A, B, C, and D rails as entire groups on seven railroads stand to each other numerically as 100 to 100 to 78 to 66, relations which are, nevertheless, reversed on certain other roads.

The opinion seems firmly fixed in the minds of the users of rails that certain year's rollings are especially prone to display transverse fissures. The volume of testimony is sufficient to make it clear that certain heats display greater durability than others, giving more definiteness to this phase of the case than expressed in intervals of time. In the absense of evidence touching upon this aspect of the case it hardly seems justifiable to give credence to all those surmises which would impugn so many hundreds of heats and thousands of rails.

Rails of Bessemer steel which have displayed transverse fissures are few in numbers when compared with those which have occurred in open-hearth product. However, Bessemer rails which have dispayed transverse fissures are not, taken as a group, few in number.

Transverse fissures have also been produced experimentally by subjecting rails to treatment analogous to the cold-rolling action of wheels. This result was accomplished by repeated, alternate, overstraining the rail longitudinally. Half-length rails were used, applying gagging blows at short intervals along the length of the head, then reversing the bend and gagging the base in the same manner. The position of the interior fissure was found controllable at will. Gagging the rail in upright position yielded a transverse fissure centrally over the web; inclining the rail to the right or to the left and applying the gagging blows in an oblique direction yielded transverse fissures located in the right or left side of the head, whichever way the rail was canted.

The effects of wheel pressures, as they are received by the zone of metal at the top of the head, constitutes the essence of the rail problem. It is, per se, the rail problem.

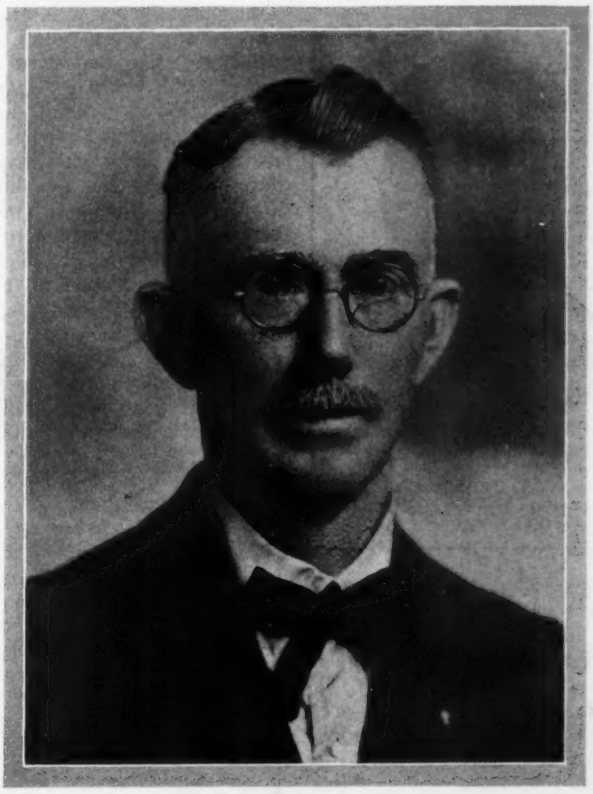
Internal strains of magnitude are introduced by the cold-rolling action of the wheels. They remain as permanent factors in the loading of the rails, even when no rolling stock is being carried by them. These internal strains not uncommonly exceed the direct track stresses produced.

The most obvious deduction to be made from this compilation of data on the display of transverse fissures is the apparent close approach to the limit of endurance experienced by rails under the conditions of service which now prevail on the trunk lines of the country.

The Roadmasters Hold Successful Convention in Chicago

Program Characterized by Unusually Practical Character of Addresses and Committee Reports

THE FORTY-FIRST annual convention of the Roadmasters' and Maintenance of Way Association, which was held at the Hotel Sherman, Chicago, on September 18-20, was one of the most successful in the history of this organization. The outstanding feature of the convention was the high standard of the reports and addresses which were unusually practical. Of special interest were several addresses by railway executives emphasizing the broader responsibilities of railway employees in counteracting the flood of hostile propaganda by utilizing every opportunity to present the facts to those with whom they come in contact at every opportunity. Among the speakers who presented this phase of their work to the members of the association were W. G. Bierd, receiver, Chicago & Alton; Hal S. Ray, director of personnel and public relations, Chicago, Rock Island & Pacific and F. W. Sargent, general solicitor, Chicago & North Western. In spite of the unusual demands which this season's activities have placed upon the members of this association more than 300 roadmasters and engineers responsible for the maintenance of tracks were in attendance at the convention.



J. P. Corcoran
President

Mr. Corcoran's succession to the presidency of the Roadmasters' Association represents a definite recognition of the earnest effort and whole-hearted interest which he has taken in the association's affairs ever since his election to membership in 1910. He has served repeatedly as chairman of committees and was a member of the executive committee in 1918 and 1919, following which he served in turn as second vice-president and first vice-president. Mr. Corcoran is roadmaster on the Northern division of the Chicago & Alton, with headquarters at Bloomington, Ill., a position which he has held since 1909.

The officers of the association during the past year were as follows: President, J. P. Corcoran, roadmaster, Chicago & Alton, Bloomington, Ill.; first vice-president, J. B. Martin, supervisor, New York Central, Elkhart, Ind.; second vice-president, W. F. Muff, roadmaster, Atchison Topeka & Santa Fe, Newton, Kan.; secretary, P. J. McAndrews, roadmaster, Chicago & North Western, Sterling, Ill., and treasurer, T. F. Donahoe, general supervisor of road, Baltimore & Ohio, Pittsburgh, Pa.

Address of President Corcoran

In calling the convention to order on Tuesday morning, J P. Corcoran, president, emphasized the importance of the members participating actively in the discussion of the reports which were to be presented He called attention to the fact that the Roadmasters' Association was organized to afford an opportunity for the exchange of information between men engaged in the maintenance of railway tracks. It is a valuable means of educating engineers, roadmasters and supervisors regarding the means of handling their work most economically. He also referred to the necessity for roadmasters to take part in the discussion of the railway problem, speaking in part as follows:

"The roadmasters, supervisors and engineers who compose our membership are now called upon to participate in one of the most active discussions of the railway situation that has ever occurred. The attempts of a certain group of politicians to force the railways into government control calls for the greatest activity on the part of every railway employee in the dissemination of the facts regarding private and public operation. I do not know of any group of railway men who come more frequently in contact with merchants, public officers and politicians while traveling over their lines and who should be able to talk to them more intelligently than the members of our association. We should inform ourselves regarding the necessity for the maintenance of rates at the present level in order that the railways which employ us can so maintain their tracks, bridges and buildings as to be able to give the public the service which it demands. The American public is inclined to be fair and will display sound judgment when it is in possession of all of the facts and we owe it to our roads to see that all with whom we come in contact are fully and correctly informed.

"We are now approaching the conclusion of the most active season for many years. Railway traffic is moving in unheard of volume. New records are being broken almost weekly on nearly every railway. This traffic is increasing the wear and tear on tracks and structures.

All indications point to its continuance throughout the winter. It is, therefore, important that trackmen should give due consideration to the burdens to be placed upon their rails this winter and utilize as efficiently as possible the few weeks that remain in bringing their tracks up to the best possible condition before they become frozen."

Giving the Public the Facts About the Railroads

By HAL S. RAY

Director of Personnel and Public Relations, Chicago, Rock Island & Pacific, Chicago

THE purpose of your organization is to enable you to get together for the benefits which may accrue to you as representatives of a great and important branch of railway service. There is now a need of something more than that phase of education. There is a greater need today than at any time in many years for an active campaign on the part of every loyal railroad man to present the facts about the railroads at every opportunity.

As a supervisor on the New York Central, Western Lines, at Elkhart, Ind., Mr. Martin is responsible for the safety of the tracks which carry the several sections of the Twentieth Century Limited. He is one of the younger members of the Roadmasters' Association, having joined in 1916. In 1920 he was chairman of the Committee on Highway Crossing Construction, since when he has served as a member of the Executive Committee and as second and first vice-presidents, respectively. He was also the first president of the Maintenance of Way Club of Chicago.

J. B. Martin
First Vice-President

It is quite common to refer to two fundamental principles on which our industrial fabric and our prosperity is built. The first of these is almost invariably said to be agriculture. Agriculture is essential in the first degree to our life, but agriculture in the scheme of today would be grossly and sadly inadequate if it were not for transportation. Yet there are men, who make the assertion that transportation is all wrong.

The departmental organization of railroads in this country leads very naturally to the conclusion that if we do our job the best that we know how and see to it that we find out all that we can about our business we have performed our duty. We must get away from this departmental idea. We must realize that we are members of one of the greatest industries in the world, and that the men who are controlling the railroads today are honest men, who know their job and who, in the face of all of the obstacles, are trying to do good work and who seek your co-operation so we can all work together.

The attitude of the people toward the railroads has changed in recent years. Originally we were sought after. The men who developed the railroads, who had the courage of their conviction to go out into the wilds were welcome. The people did everything to get them. Yet today men are going up and down the country saying that the railroads are this, that, and the other thing which they should not be and are nothing that they should be. That is the thing that I resent, and that is the thing that you want to resent.

Attacks are based on various charges. For instance, the statement is made over and over again by men who know better or could know better if they would seek the facts, that under the transportation act the railroads are in a special class, and that by class legislation their earnings are guaranteed. Now let's see what that means. The Transportation Act was drawn by Senator Cummins and Congressman Esch. Both of these men have said over and over again that the Transportation Act guarantees the railroads nothing. It never did since the railroads passed out of Federal control and never will. The Transportation Act provides that if the railroads are fortunate enough they may earn 5¾ per cent, but the Transportation Act also limits their earnings in that if a railroad is fortunate enough to earn more than 5¾ per cent it must return to the government one-half of all beyond that figure. Tell the people with whom you come in contact that all government contributions and financial aid to the railroads ceased in September, 1920. And that since then they have not received a particle of financial help in the way of guarantee or the like.

Valuation is another topic of attack. A certain senator who is very active now in his protests against the situation and who is the spokesman of the school which claims that the railroads are overvalued, was convinced that something ought to be done. In 1914 he wrote a law which was passed and which provided that a valuation of the railroads should be made in a certain specified way. Well what happened? The result expected didn't occur. It was found that instead of water the railroads had an actual value as announced by the Interstate Commerce Commission in excess of their capitalization. Immediately this doctor of the railroads said, "Let's get some new medicine and try it on the patient," so the present program was proposed, which means nothing more than the beginning of a campaign to tear down values. Remember that this valuation was made by the Government's rep-

Mr. Muff is a roadmaster on the Santa Fe at Newton, Kan., where he has been located for the past 15 years, with the exception of a short leave of absence, during which he was engaged in the railway supply business. He obtained his first supervisory position in 1904 on the Chicago & Alton. Mr. Muff has taken an active part in the discussions on the floor of the convention since he became a member in 1908. He also served both as a committee chairman and as a member of the executive committee before his election as second vice-president.

W. F. Muff
Second Vice-President

resentative, the Interstate Commerce Commission and that all of this cry about overvaluation is pure political bunk.

What is the purpose of all this? I can't see any other answer than that it is a well defined plan on the part of some one to bring the railroads under Government ownership. They talk about the great efficiency of the government. We know what happened during federal control, but we will admit that that was a very unusual period. But what is the other experience? We could go to Italy, or to France, where they have turned back some of their Government owned railroads. But let's look on our own continent at Canada. We have the Canadian Pacific of approximately 13,300 miles, owned and operated privately, earning and paying dividends of 7 per cent and adding to that 3 per cent from other sources making a total of 10 per cent in a year. There are also some 18,000 miles of Canadian Government railways owned and operated by the Canadian Government under very similar conditions, by the same general type of intelligence. Did it pay 10 per cent in dividends and taxes to the Government? No it earned a deficit of one hundred million dollars, which must be borne in taxes by the eight million people in Canada. And in the meantime the Government gets no taxes from this property.

I am citing these facts to give you something to talk about when you have the opportunity. There is no group of railway men who have it more fully in their power to disseminate the facts about the railway situation.

If anything should happen to break down the efficiency of our railroads, whether it be government control or what not, we shall suffer as citizens just as badly as we shall suffer as railroad men, and perhaps worse. There is nothing which so vitally touches every daily activity as transportation. This country has reached the apex of its present success largely because of its superior transportation facilities which you men have helped to make. Shall we go on and further advance the interests of our country and build a greater and better United States or shall we let some selfish politicians break down this industry which you and I are proud to work for?

Mr. McAndrews has been a roadmaster on the Chicago & North Western's main line between Chicago and Omaha for many years, and is the third secretary of the association in succession from that road. It is also of interest to note that he not only succeeded L. C. Ryan as secretary, but also as roadmaster at Sterling, Ill. With eight years' service as secretary, he has a longer record in that position than any of his predecessors. Previous to his election as secretary he was president of the association in 1915.

P. J McAndrews
Secretary

Report of Committee on the Maintenance of Large Yards

THE maintenance of large yards and yard tracks covers a much wider scope of activities than ordinary main track work, because of the many different conditions that affect it. Among these are the constant interruption by yard operations, the many different kinds of tracks to be maintained, the kinds of loads passing through the yard in different directions, the greater number of heavier loads moving over one part of the layout than another, the weight of the engines used and the character of the sub-grade on which the yard is constructed.

The problems created by the improper design of yard layouts as well as initial construction done on a temporary basis, particularly with respect to drainage, exert a very direct influence on the economical maintenance of the yard after it has been put in service, and, while this report does not deal directly with this question, it is one that is later reflected very considerably in traffic interruptions, as well as maintenance costs, and should be studied very carefully before money is appropriated and expended for construction. Such conditions occur most frequently where additional yards are developed on limited areas to take care of increasing business, and where construction work is rushed through to put the tracks in sevice at the earliest possible time, on account of an already existing need.

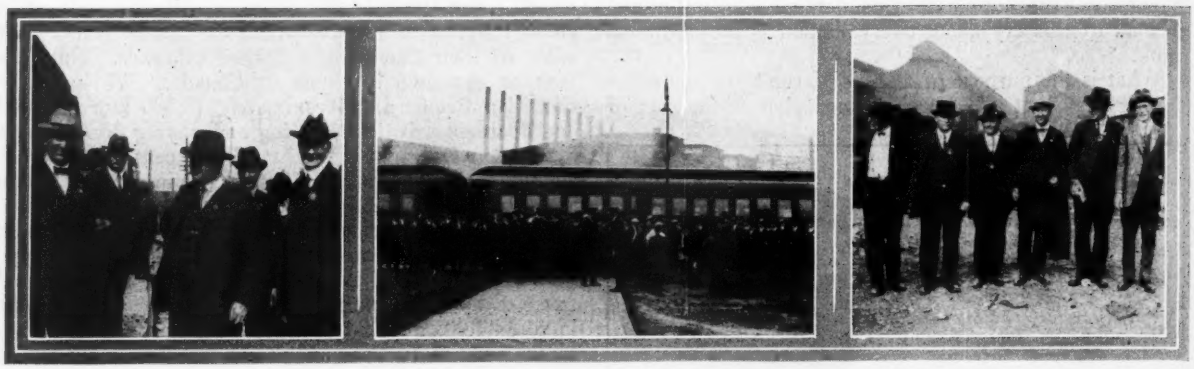
A properly balanced maintenance force, by sections, should be developed on an equated mileage basis, taking into consideration not only the mileage of the different classes of tracks, the number of switches and the drainage conditions involved, but also the special operating conditions affecting each section, so that they are all as nearly equal as possible in the amount of work to be done. Nothing is more discouarging to a foreman than to be overloaded with duties, whether he may have more force or not, while his neighbor has fewer responsibilities and less work with the same compensation. A careful study of the maintenance needs, together with the available foreman material, should also be made, in order to place each man in the place where he will be most useful and at the same time, if possible, best satisfied with respect to living conditions for his family and himself.

Mr. Donahoe was elected treasurer of the association in 1921, by action of the executive committee, following the death of Coleman King, and has been regularly re-elected as treasurer by the conventions since that time. He has also seen previous service as an officer in the Association, having served in 1912 and 1913 as vice-president, and the following year as president. Mr. Donahoe has had an active part in the supervision of track maintenance on the Baltimore & Ohio for the past 20 years, first as a supervisor and subsequently as general supervisor at Pittsburgh, Pa.

T. F. Donahoe
Treasurer

A Program Is Essential to Efficient Work

While there is no maintenance work that suffers more interruptions and drawbacks than yard work, and no kind as difficult to plan and carry out as planned, the planning of work by seasons, and close supervision to assist in its



The Election Was Satisfactory to All

At the Station at Indiana Harbor

The Association's Officers Were Present

being carried out as nearly as possible in accordance with the schedule, is very necessary. There should at all times be a clearly defined plan to follow with an understanding as to the next most important task, in case the yard business prevents the most important one from being done at the time. One method of preparing such a program which has been used with distinct advantage over some other methods, is for the supervisor to cover each section with the foreman in charge about the first of the year, or at a convenient time before spring when the tracks are clear of snow, and make a careful study of the maintenance needs of the section on the ground, after which a schedule is prepared of the different stretches of tracks to be worked during the year, in the order of their importance. This schedule should show the estimated amounts of material needed for each stretch of track. The supervisor should give a copy of this schedule to the foreman and retain a copy for his use.

This Should Have Supervisor's Attention

This work should not be delegated to anyone, but should be handled personally by the supervisor and the section foreman. Such a program should be prepared only after very careful study and discussion of the advisability of the order of preference in carrying out the work. Of course, no such schedule, particularly one of yard maintenance, can be followed to the letter. Many things develop to interfere with such a definite plan, but, notwithstanding this, the increase in the volume of work accomplished during a season with such a carefully mapped program is very marked. This is not only a decided advantage to the foreman, but probably even more so to the supervisor, as he is familiarized with all of the detail problems of his year's work, as no other method will enable him to be. He is also able to distribute materials to much better advantage so as to keep all of his section groups working without lost motion, particularly if there is a shortage of any kind, or if there are conditions which do not permit of the proper kinds of material coming to him in the most desirable order.

Another very important question in promoting yard maintenance is to eliminate as much paper work by the foreman as possible, to enable him to remain with his gang. This is especially important, as yard work involves many reports and a foreman is frequently overloaded with them, to the detriment of the direct supervision of his work. His reports should be cut down to such kinds as keeping time, preparing reports of accidents due to track conditions and making monthly reports of gage, line and surface conditions, etc., for which he is directly responsible. All other current reports should be handled by some one delegated by the supervisor, who can handle this work for several sections, or for a whole yard of moderate size.

Materials Should Be Concentrated at a Central Point

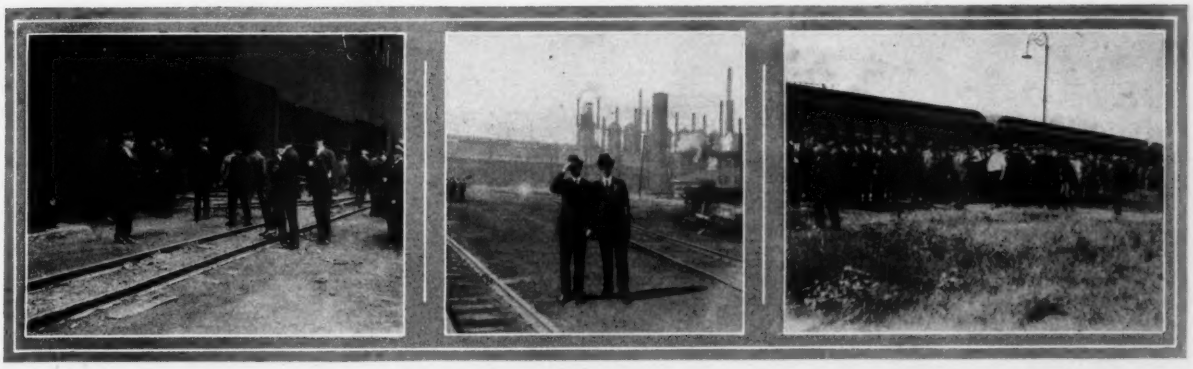
Materials should not be scattered through the yard, except a small supply for emergencies, but should be located in a material yard, as centrally located as possible, with supporting tracks so that the unloading and loading will not be interfered with by the yard operations. Rails and other heavier materials should be handled by small derricks or rail loaders, and only distributed for use when needed. They should be piled neatly by kinds, and plainly marked so that no errors will be made in distribution or in the preparation of material reports. Small parts, threaded and insulated materials, should be kept under cover at the same location, so that while the heavier materials are being loaded, preferably with a derrick, a part of the gang can be assembling the bolts, splices, switch plates, and other materials it is necessary to handle at the time.

It is also profitable to have an air line to the material yard, so that a maintenance of way shop can be maintained for reclamation and repair work in conjunction with an oxyacetylene outfit. A small sawmill can also be operated to excellent advantage in the manufacture of suitable lumber and wood paving blocks from solid parts of old swith ties; old telegraph poles and other suitable discarded timber; also a concrete mixer for use in preparing concrete for curbing, foundations for small buildings, etc., or for mixing cold patch tar products for road crossings and platforms, if the volume of that kind of work is found to warrant its installation.

A small maintenance of way storehouse, either in charge of the supervisor or the local shop storekeeper, with about a two months' supply of materials on hand is a distinct advantage, all materials coming to the yard passing through the storehouse from the division storekeeper. The small surplus will save delays in maintenance work, and the system of having the foreman receive their materials from the local storekeeper will eliminate the extra work of breaking up the supply into so many packages and shipments, and avoid losses in transit and a very considerable amount of clerical work.

Scrap should be systematically assembled into scrap boxes that can be picked up and dumped into cars by means of a small derrick equipped with a magnet or a rail loader.

Special instructions that will best apply for each particular yard should be prepared for cleaning up scrap and



Entering the Rail Mill | A. M. Clough and Jas. Sweeney Enjoyed the Trip | Ready to Start Through the Mills

also for keeping the yards clean of rubbish, coal. etc. This work varies in volume according to the commodities that pas through the yard, and is particularly troublesome with high loads in open top cars, such as coal and coke thrown back in the cars, keeping the territory fully covered and cleaned each day. The matter of policing yards is most important, and deserves more consideration than it frequantity gets, not only from the standpoint of good house keeping, but of safety as well.

The matter of using heavier rails in yards and tracks is one that is frequently neglected, on account of a considered existing need of such material on other parts of the railroad. This, in our opinion, is often done at a tremendous loss in maintenance. Rails in all yard tracks should originally be at least of 85-lb. section. First or second-class fit rails are satisfactory, the first-class rail to be used on the more important running tracks and ladders. This plan, if followed will very materially reduce the cost of ties, and line and surfacing, and, in every case, we feel that it will more than equal the cost of the additional weight of rail applied. With our present types of coal cars, a large per cent of which weigh 210,000 lb., (combined weight of car and lading), and the heavy switching locomotives, this matter deserves most careful consideration.

Other Details

There are many details in maintenance which are being followed to excellent advantage on many railroads for road work, but are given less consideration in yard maintenance, some of which are suggested as worthy of special consideration as follows:

a. Adequate drainage.

b. Application of switch point guard rails ahead of the sharper leads.

c. Application of rail anchors where needed.

d. Tie plating all main tracks, engine tracks, and ladder tracks throughout, and all other tracks where traffic develops mechanical wear on ties.

e. Milling of stock rails to increase the life of switch points.

f. Carefully supervised joint maintenance.

g. Careful distribution of ties and rail, taking into consideration the tonnage handled over the different tracks, together with the subgrade conditions.

h. Monthly reports of track condition, as to gage, line, surface, etc., made by the foreman after careful personal inspections.

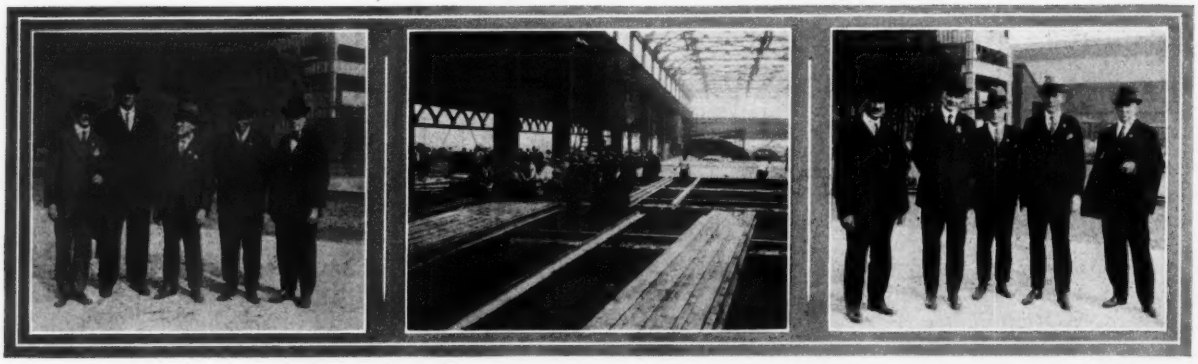
i. Careful study and adoption of labor saving devices.

One of the most important factors in getting results in yard work is co-operation. Allotments of labor and material mean far less, and suggestions for good practices and their application are less effective if there is no real co-operative spirit between the supervisor and his forces as well as between the maintenance of way department and the transportation people. The work to be done that will necessitate the absolute use of a track for a few hours or more, should be anticipated sufficiently in advance by the foreman or supervisor to enable the yardmaster to plan accordingly so as to help him out. On the other hand, in making track repairs, no materials should be left lying between the tracks of yards or adjacent to any tracks where they may cause injury or inconvenience to trainmen, especially over night, and all ballast should be levelled, particularly in inter-track spaces. A good plan is to take night trips through the more poorly lighted portions of the yard with the foreman frequently. This will impress him more forcibly than letters regarding the real necessity of keeping the yard free of surplus materials and thoroughly clear of obstructions.

Lastly, we consider as important as inter-departmental co-operation, the spirit of helpfulness to be shown at all times by the supervisor to the foremen. Keep out on the job with them as much as possible. Not only plan their work by seasons, but study their daily problems and help them to overcome them. Keep them supplied with the necessary materials to do their work as nearly as you can and help them to get their work done by giving them the benefit of your experience as well as by co-operating with the other departments. It is not only a supervisor's duty to do this, but he should manifest an interest in the personal side of the foreman's life, to show him that supervisory forces are created to be helpful, with their better judgment and more varied experiences, rather than to be merely "bosses" as they may sometimes designate themselves.

The policy of giving friendly advice in matters that do or do not deal directly with the foreman's work never fails to make him a better foreman, and always makes the work, however difficult or trying it may be, go better. Do not ever lose sight of the fact that a good foreman is just as good at sizing up human nature as you are, and while he may not be one hundred per cent in all the requirements as you see them, he is more sensitive, because of these shortcomings. It is up to the supervisor to get results with the material at hand, and by showing a real human spirit of helpfulness, he can develop a man that is frequently far beyond your expectations.

Railroad organizations, which must necessarily be stable and lasting, are after all built on loyalty, and loyalty is developed only by co-operation and helpfulness, which should manifest themselves at all times. There is no other sub-officer more favorably situated to help his



The Alton Was Well Represented

Watching the Inspectors Pass the Rails

Some of the New York Central's Representatives

company and the company's organization in this respect than a track supervisor, and we feel that such a policy is even more necessary for stimulating maintenance activities in yard work, because of its many and perplexing problems which are being constantly added to by heavier loads, and the public's ever increasing demand for better and prompter service.

R. W. E. Bowler, division engineer, Penna., chairman; William Skelton, supervisor, N. Y. C.; D. C. McGregor, supervisor, B. & O.; George Brooks, roadmaster, Terminal Railroad Association of St. Louis; J. B. Kelly, assistant general roadmaster, M. St. P. & S. S. M.; D. O'Hern, roadmaster, E. J. & E.; M. Ganley, roadmaster, A. T. & S. F.; M. J. Griffin, supervisor, C. R. R. of N. J.; C. T. Kimbrough, roadmaster, I. H. B.; and W. Hogan, supervisor, B. & O. C. T.

Discussion

D. O'Hearn, (E. J. & E.) emphasized the need of adequate supervision in yard maintenance. All large yards on his road, he stated, were either under the direction of a general foreman with several assistants or were divided into two or more sections, each in charge of a foreman. Provision is also made for a time keeper or clerk who handles all time books and keeps the material records so that the foremen are entirely relieved of this work. He also advocated the generous use of labor-saving equipment and cited the use of locomotive cranes equipped with clam shell buckets for picking up dirt and with magnets for handling scrap. He also told of the advantage of providing a yard with a large motor car capable of handling two push cars loaded with switch or other material, as a means of avoiding the use of a work train..

Considerable discussion centered about the practicability of preparing a program for the conduct of yard maintenance, the opinion being that although such programs are highly desirable, the possibility of following them closely is rather remote, but in spite of this considerable advantage is desired from the preparation of such programs, for, as stated by T. F. Donahoe (B. & O.), the preparation of the program indicates that considerable thought has been given to the problems in hand, and this means that the work will be much better done even though the program itself is not followed.

The protection of switch points was the subject of considerable discussion, E. W. McGarvey, (Penna.) going into considerable detail concerning the results secured by milling stock rails to provide a recess in which to conceal the end of the point and thus protect it from the battering action of the wheel flanges. Other suggestions offered were the installation of a switch point protector bolted to the stock rail in advance of the point or the welding of a protection on the gage side of the rail head for the same purpose. This was objected to by A. M. Clough, (N. Y. C.) who contended that the use of manganese steel switch points in which the points can be reduced almost to a feather edge will do away with the difficulties encountered in switch points having an appreciable end thickness.

Report on the Education and Development of Track Foremen

THIS subject naturally allows division into two parts. (1), the education and development of laborers to fit them for positions as track foremen, and (2), the education and development of the present track foremen, to make them more capable and satisfied foremen and consequently fit them for promotion. Your committee believes that both phases of the question are of equal importance and this report is prepared accordingly.

The Importance of Education

The constantly growing importance of economy in all branches of railroad work accentuates the need of education. Notwithstanding acute periodic shortages of track labor, track foremen are required and expected to meet changing conditions. Your committee feels that the results obtained by individuals and in some cases by railroad systems, through systematized education is the best argument in its favor.

Your committee is convinced that some of the benefits which come with education are:

First—The creation of loyalty. The importance of loyalty cannot be over-stressed. This is particularly true of the track department organization. In time of storms or accidents, track foremen necessarily have to take the initiative and lead their men into physical hardship, supported only by an appreciation of responsibility and duty. Disgruntled or disloyal men cannot be expected to render emergency service of this kind to the same extent or degree as satisfied, loyal men. Since education indisputably promotes both loyalty and contentment, it is important in building up the morale of the organization.

Second—Sustaining interest. There are many artificial ways of creating interest in work. Offering bonuses and introducing competition are illustrations of what your committee chooses to term artificial methods of creating interest. Your committee does not advise against the

The C. & E. I. Was Out in Force

From the Atlantic Coast Line and the Florida East Coast

Going Through the Steel Plant

use of any of these methods. However, as a rule it does believe the interest created by these methods is short lived. It further believes that interest can be more effectively sustained through educational methods since interest of that kind is real and earnest because of its being built upon a secure and lasting foundation.

Third—Teaching men to think. No one will deny that a thoughtful man will accomplish more with the same expenditure of effort than a thoughtless one. To teach men to think is to teach them to arrange their ideas in logical sequence and to determine the correct values for the elements entering into every piece of work. These elements are the time, cost and permanence which the circumstances justify or require. Your committee feels that this is the proper place to dwell with emphasis upon the possibility of the education of subordinate employees by their superior officers. Whenever a superior officer, through discussion with a subordinate allows the subordinate to comprehend the mental process by which a conclusion has been reached, that officer is teaching his subordinate to think. In planning the sequence of several different pieces of work, if the officers, instead of arbitrarily directing a special sequence, will disclose the reason for that sequence he is giving the subordinate an insight into the values used by him in arriving at his program which will be of benefit to the subordinate when thrown upon his own resources. Your committee believes that too frequently subordinate employees are placed at a disadvantage by their officers in the performance of work by not being given the benefit of discussion which would clarify many points in doubt and enable the subordinate to perfom the work to be done more readily and satisfactorily. To this end your committee recommends that officers cultivate tolerance and patience in dealing with subordinates and believes that this attitude will do much to further education through personal contact.

Your committee believes that both foremen and supervisors should be impressed with the fact that the development of men for promotion is a distinct credit to them. Jealousy is one of the most deep seated and cruel of human passions and will ever be a factor with which mankind will be forced to contend. However, jealousy of men who show fitness and ability, while a natural feeling, is an illogical one. Men should be made to feel that it is to their credit to develop their subordinates and that this is a factor by which their worth is judged. Your committee feels that it is only proper to mention the outstanding work of Andrew Clough, past president of this association, and supervisor of the New York Central at Batavia, New York, in the development of his subordinates and in acknowledgment thereof, your committee offers its congratulations.

Your committee believes that every possible influence should be used to bring about uniform track forces, based upon a fair minimum. Work which can be performed during the winter months should be carefully studied and conserved for that period. Your committee feels certain that this system would do much to stabilize the working force and aid materially in securing desirable laborers and the consequent development of these men first into foremen and later into supervisors. Comment is hardly needed upon the difficulty of educating and developing men when there is a high labor turn-over. When the continuity of work is doubtful, the good men are the first to leave for they know that they can secure continuous employment elsewhere and their intelligence and ambition, the very traits that make them valuable to the railroads, lead them to seek other employment.

Many railroads have already established adequate differentials between the rates paid their foremen and their laborers. Your committee feels that the incentive afforded laborers to remain in railroad employ and develop themselves into capable foremen is greatly enhanced by sufficient differentials and believes this feature should receive careful consideration in connection with the development and education of men.

The Education and Development of Laborers

Employment of Men: The type of men employed frequently determines the extent to which they may be educated and developed. In many industrial centers or districts the track foremen have slight opportunity to pick and choose. More often the number of men available is inadequate. This condition seems destined to continue when the underlying causes are examined. Most industrial plants are compact units, each in charge of an executive officer authorized to change labor rates to meet the ever variable demand based on supply. This is a marked advantage over a railroad system which covers extensive territory and has to make changes in rates in one locality with some regard to the effect it will have upon another locality. Often the executive officer authorized to make a change in rate is located at some distant point and does not possess complete knowledge of the situation. Yet more important is the fact that railroad track does not reflect lack of maintenance immediately. It takes some time for track in good condition to manifest insufficient work. This causes railroad officials to be slow in adopting a change in rate even when that is the only expedient for obtaining needed men. On the other hand, in most industrial plants there is a direct effect of a shortage of labor. It frequently means a more or less immediate curtailment of production and since there is a visible reaction between cause and effect, most industries can

justify vigorous and energetic measures. Because of these facts, your committee feels that industrial centers or sections are not fertile fields for the development of laborers into track foremen and while an attempt to educate the laborers should bear dividends in better work and a greater amount of work per man, your committee warns against too great expectation in the development of capable foremen under these adverse conditions. The solution your committee offers is that more intensive education and development of laborers should be attempted in agricultural and forested sections and the industrial centers supplied with foremen therefrom. It is appreciated that there are some lines which lie wholly within industrial sections and upon which this plan is not feasible. Such lines will have to make the best of the men they can develop and supply the deficit by employing men from elsewhere which, according to the information of your committee, is what is now being done to a large extent.

Apprentice System: Some roads have experimented with an apprentice system with more or less indifferent success. Some failures can be attributed to abuse, others can be charged to lack of interest and effort on the part of officials. One form of abuse has arisen where foremen or supervisors have been permitted to employ apprentices, using the authority for the employment of additional laborers who were not apprentices in any sense of the word. Your committee feels that some practical apprenticeship system could be worked out and suggests the following scheme to be modified as conditions direct. Employ boys from 17 to 19 years of age with the usual minor's release. See that they have at least a common school education. Pay them two-thirds the laborer's rate the first year, the standard labor rate the second year, a differential of from 2 to 5 cents an hour the third year, and give them the title and pay of assistant foremen the fourth year. Boys who show no aptitude nor interest in track work should not be encouraged to finish the apprenticeship, while those who do show these qualities should be encouraged and tutored, both by the foreman and supervisors. The first year should preferably be spent on an outlying section, the second year in an extra gang assigned to ballasting out of face, the third year in an extra gang laying rail and the fourth year in a terminal yard. Apprentices should be encouraged or perhaps assisted in taking a correspondence school course dealing with track work. They should be made entirely familiar with timekeeping, material records and the other clerical work devolving upon a foreman. Care should be exercised to see that no more apprentices were employed and developed than the road required to fill vacancies. This scheme would require close and interested supervision.

Rotation of Capable Men: Your committee wishes to emphasize the importance of the rotation of capable men, aside and apart from the apprentice system. Capable men interested in track work should be given ample opportunity to learn all of the various phases thereof. Too frequently capable and reliable men who were good timber for further development have preferred to stay on outlying sections because their early experience has not embraced extra gang and yard work and the complication and intricacy which could easily have been mastered remained to them a closed book, cowing them into a preference for what they know, stunting their development and withholding from their roads valuable services.

Recognition of Ability Among Laborers: Track foremen should be encouraged to turn their forces over to laborers occasionally who have had experience and show ability in order to determine whether they have the requisite qualities for development into foremen. If they discover the necessary ability in these men they should continue to develop it until in their opinion the men are ready to qualify. The supervisor should be advised as to the progress of the prospect and informed when he is ready to qualify. The Grand Trunk uses this system, and when the foremen informs the supervisor that his man is ready to be made a foremen he calls the prospect into division headquarters and gives him an examination in the rule book, looks him over, and if acceptable, promises him promotion when his turn comes if no opening is immediately available. Your committee is informed that this system has worked excellently. The education and development of laborers must necessarily devolve principally upon the track foremen, and your committee recommends that this be impressed upon them as an obligation they owe their company as much as their loyalty, interest and judgment.

The Education and Development of Track Foremen

Personal Contact: The education and development of track foremen through personal contact with their supervisors has already been touched upon. However, the importance of this feature is thought sufficient to warrant further emphasis. Your committee believes that the day is past on American railroads when the chief duty of the supervisor was thought to be riding trains and throwing "butterflies" to the foremen. The present necessity for economy in the performance of work and the use of materials compels closer supervision than was possible under the train riding system. The closer personal contact of the present time has not only developed a closer relationship and understanding between the supervisors and the foremen but has also greatly benefited the development of the foremen. Your committee believes that what has been accomplished in the past is only a promise of what may be achieved in the future, provided the need for this development is understood and all advantages taken of the broad opportunity that this contact affords.

Magazines: Many roads have already adopted the practice of subscribing to magazines devoted to track and maintenance work for foremen. Some roads give each foreman an individual subscription while others circulate a certain number on each supervisor's territory. The information your committee has obtained is that these magazines are closely and carefully read and that the foremen and even the better laborers obtain much benefit from them. Your committee strongly endorses subscription to such magazines and believes individual subscriptions are amply justified in order that foremen can refer back to previous numbers when occasion demands. Supervisors should discuss interesting articles with their foremen, both in order to determine whether the magazines are being read and also in order that the greatest benefit from such articles will be derived.

Correspondence School Courses for Foremen: When any foreman shows a disposition to improve himself by taking a correspondence school course dealing with his work your committee assures you that he deserves encouragement. It is the men who try to help themselves that deserve help. Should a foreman express a desire to take such a course, his supervisor should at least arrange to permit a pay-roll deduction for the payment. There are doubtless many foremen who are not aware that courses dealing with track work are obtainable. A supervisor interested in the development of his men should see to it that his progressive foremen, if not all of his foremen, know of the opportunity. Anyone who has come in contact with this plan of education must be struck by its results. Your committee takes the liberty of referring to a paper upon this subject presented by D. C. Buell, Director of the Railway Educational Bureau, Omaha, Nebraska, at the 1922 Convention, and also to the dis-

cussion which followed. This will be found in the proceedings of that convention and every supervisor is urged to read it.

Associations for Foremen: Your committee has been kept in close touch with The Kansas City Southern Maintenance of Way Association by the chairman and believes it a medium of development and education of sufficient merit to warrant description and discussion. This association fulfills all of the fundamental requirements of creating loyalty, sustaining interest and developing men by providing an intimate and direct means of contact, not only between the foreman and his own supervisor but also with other supervisors and the higher maintenance officers. The chief engineer who is in direct charge of maintenance is the chairman and presides at all meetings. Attention is called to the fact that the organization entirely eliminates elective officers, together with the disturbing factional politics that invariably goes with it. One meeting is held each month on alternate divisions. Foremen, supervisors, engineers and occasionally officers are invited to prepare papers on assigned subjects. To show the interest taken, no one has yet refused or failed to present a paper when invited and some of the best papers have been presented by the foremen. Following each paper the subject is thrown open for discussion, which is participated in generously, by foremen, supervisors and others present. It is rare that officers from other departments are not visitors and whenever possible the general manager attends. A stenographic record of the proceedings is kept and as soon as practicable after the meeting this record is published in a printed bulletin and sent out to the entire membership. In addition to the proceedings, this bulletin contains editorials, excerpts from other magazines and frequently an article of educational nature by some officer. These monthly bulletins, gotten out in attractive form, are read closely by supervisors, foremen and many laborers. Through requests, more than one hundred of these bulletins are mailed to officers of other railroads, and many articles appearing in these bulletins are reprinted by such magazines as *"Railway Engineering and Maintenance,"* "The Railway Review," the bulletin of your association, and numerous publications of other railroads. The secretary of this association is employed by the railroad and devotes approximately two-thirds of his time to the association and its bulletin.

The attendance at the meetings ranges from 70 to 80 on the Northern division to 60 to 70 on the Southern division. The meetings are attended by about one-half the track foremen of the division on which the meeting is held, all of the supervisors on that division, and each time a few men from the other divisions in order to preserve the interest in the association as a whole. The secretary makes arrangements for meals, the expense of which is borne by the company. At the evening meal, after-dinner speeches are called for from municipal officers who are invited to dine and also other visitors or visiting officers. During the three years this association has been in existence not once has either a foreman or supervisor had the remotest suggestion of a rebuke or call down at a meeting. At first the foremen were somewhat reticent and their attitude disclosed a lurking suspicion that they were assembled in order to "raw hide" them better and more effectively. As soon as this suspicion was dispelled they became enthusiastic and at the present time they look forward to the meetings and vie with each other for an opportunity to attend. The railroad is satisfied with the results obtained through the association and considers the expense a wise investment, both from its standpoint and also from the standpoint of the men. Visitors from other railroads are always struck by the loyalty, interest, and good morale of the foremen and frequently comment at length upon the superior class of foremen developed through the association. Your committee belives that the results obtained by The Kansas City Southern through this association amply justify careful study and where possible an adaptation of this method. While other lines have employed this plan to a limited degree, your committee knows of no road which has developed it as completely and given it the dignity of the association herein described and in no small degree your committee believes its success attributable to these features.

Systems of Developing Men: If hell is paved with good intentions, so the failures of individuals, and even of organizations are founded upon good systems neglected. A system does not perpetuate itself. The best system may produce an utter failure if negligently applied. On the other hand, a poor system may produce surprising results if painstakingly carried out. It is then not the system of itself that achieves success or begets failure, it is the method of application. Your committee directs your attention to what has been and can be accomplished through education and feels assured that if you properly evaluate the benefit to be gained therefrom the means of attaining the end will be found.

Conclusions

Your committee presents for your consideration the following conclusions:

1. That the need for and benefit to be derived from education as a means of developing men should be recognized and every advantage taken of educational methods.
2. That education creates and sustains both loyalty and interest and promotes economy.
3. That superior officers should be made to feel that it is their duty and to their credit to develop subordinates.
4. That every influence should be employed to stabilize the size of track forces in the interest of attracting better men for education and development.
5. That adequate and deserved differentials between labor rates and formen's rates be established or re-established as an incentive for good men to look forward to and await promotion.
6. That apprenticeship systems merit study and consideration.
7. That the rotation of men through the various phases of track work to broaden their knowledge is desirable.
8. That foremen should be impressed with the important part they have in discovering good men and urged to respond to the obligation.
9. That supervisors should realize the possibilities of personal contact with their men and cultivate patience and tolerance in order to reap the greatest benefit therefrom.
10. That subscriptions to magazines for foremen by the railroad is a good investment.
11. That correspondence school courses for progressive foremen are of great benefit, both to the man and his company.
12. That associations for foremen if properly organized and maintained are amply justified by the many benefits derived therefrom.

S. E. Shoup, assistant to general manager, K. C. S., chairman; G. T. Anderson, general roadmaster, K. C. S.; E. J. Boland, roadmaster, I. C.; D. C. Buell, director, Railway Educational Bureau; E C. Buhrer supervisor, T. & O. C.; J. P. Costello, roadmaster, A. T. & S. F.; T. W. Dempsey, supervisor of track, N. Y. C.; H.

Ferguson, superintendent, G. T.; T. Gallagher, roadmaster, S. P.; B. E. Haley, roadmaster, A. C. L.; N. McNabb, roadmaster, M. C., and A. Salinsky, roadmaster, B. R. & P.

Discussion

The discussion of this paper centered largely around the extent to which it is practical to provide sufficient work to warrant the retention of more than the minimum force during the winter. Mr. Shoup contended that much work which is now being done during the summer can be deferred until winter when it will afford profitable employment for men whom it is necessary to hold for emergencies or who would otherwise be laid off and lost the following season. M. Donahoe (C. & A.) contended that the clearing of the right of way, the tightening of bolts and similar work which it is possible to do during the winter on the northern roads, is not sufficient to warrant the retention of more than the minimum forces, although he stated that he had retained extra gangs and laid rail during the last two winters. B. E. Haley (A. C. L.) stated that climatic conditions on his road permitted them to retain a uniform force throughout the year. In December of each year the general roadmasters meet with the chief engineer and prepare a program for the following 12 months. The heavy work for the ensuing year is started in January and prosecuted actively without regard for seasons. J. W. Powers (N. Y. C.) stated that it has been his observation that the maintenance of uniform gangs throughout the winter has had little effect on the labor turnover, as other industries will pay a sufficiently higher wage to secure the men which they desire when spring opens up, and the men will leave the roads for other work In contrast with these opinions, J. B. Martin (N. Y. C.) stated that he thought that the railways are governed too largely by past practices and urged that they study their operations carefully to ascertain what work can be done during the winter, assembling section gangs where advisable to handle the heavier work.

The Roadmaster of Yesterday and Today

By COLONEL F. G. JONAH

Assistant to the President and Chief Engineer, St. Louis-San Francisco, St. Louis, Mo.

MY association with roadmasters began with my entrance in the engineering department, and has continued ever since, covering a period of 40 years. As I look back and call to memory some of the stalwart roadmasters with whom I became acquainted in my early days of railroading I have a feeling of admiration for their ability and achievements, for it seems to me that they did wonders with the material at hand. If you contrast the conditions under which they worked with those of the present, you cannot fail to be impressed with the fact that some improvement has been made, but I think you will also agree that none of us could do any better than they did, and possibly not so well.

The roadmaster of 40 and 50 years ago had to work with tools that were comparatively crude. There were practically no power driven machines in those days and, in fact, very little machinery of any kind. There were no modern ditching machines, air dump cars, or gasoline motor cars, and the day's performance was measured by hand labor almost entirely. The roadmasters of those days had a light rail, scant ballast, if any, no tie plates, rail anchors, spring rail frogs, split switches, or the great multitude of track accessories that have been developed in the past few years. It is true that the motive power of those days were much lighter than it is today, but we have increased the weight of rail and the depth of ballast, and have widened our roadbeds to take care of those added loads. The roadmaster of that early day had to maintain the track very generally without ballast, and in putting up earth or dirt track he was an artist that has no equal at the present time. He was also the main reliance when any trouble occurred on the road, for he was, in fact, the wrecking boss, and was the first man called upon when any unusual events occurred anywhere on the line.

The old time roadmaster was a good construction man. He was developed at a time when the American railroads were being built, and he was at the front. Many of the roadmasters of those days were men who had made records as construction foremen, and where they had a chance to display originality, initiative, and skill. Today your work is largely maintenance, where your work is more uniformly standardized. I suppose that with our changing conditions this is inevitable and as it should be; but while I approve of the standardization of methods, I do not believe in trying to standardize railway men.

In former days the roadmaster was the company's representative to a much greater extent than at present. He did a great many things that are now done by other departments. He frequently acted for the legal department and settled many stock claims, claims for crops burnt, and those resulting from overflows, etc. He acted frequently for the purchasing department and contracted for ties, piling, fence posts, bridge timbers, ballast, etc. I know men who performed these duties very well, and I believe that they could do more of this kind of work today. One of the tendencies in railroading today is to do too many things with special representatives from the general offices.

Our railroads have been built and maintained largely with labor that has emigrated from foreign countries. Years ago they came from the British Isles, and then from Germany and the Scandinavian countries. The Germans and Scandinavians learned our language quickly, and soon became full fledged American citizens, who were readily assimilated in one body politic. This type was a good man physically, and could do and would do a good day's work. Today you are dealing with a different class. We have our shifting hobo labor, and the emigrant from Eastern and Southern Europe—not as good a man physically as the man from the British Isles and Northern Europe, and one much slower to become Americanized. Here you men are in a position to do the country a real service. These laborers of foreign birth are to become American citizens. We must remember that there are no native American races except the Indians, and that we are all descended from immigrants, even if we may not be immigrants ourselves. It is only a few generations since the first white people came to this country, so we can be tolerant of the latest to come. They may, in time, become just as good Americans as the rest of us.

We hear a great deal these days about 100 per cent Americanism. There are certain groups that are writing their own specifications for Americanism and denouncing everyone who does not conform to their ideas. I believe that, in dealing with the foreigners who come into your employ, you can outline some very simple teachings for their guidance. Tell them that this is the land of equal

opportunity and equal rights before the law, that any man is a good American citizen who works when he has an opportunity, a man who will send his children to some school, a man who is honest with his fellow man, a man who respects the offices of religion, and will accord every man the right to his own political and religious opinions. These tenets are the very basis of Americanism, and you can do much to further these views among the men.

Report of the Committee on Labor Saving Devices

IT can be truthfully said of men in the maintenance of way department that since the time railroads were first built, it has been their principal effort to get the most work possible done at the least expense and in the most effcient manner. We have innumerable stories of foremen commanding their men to, "Get there," "Hurry up," and using other phraseology that could not be mentioned here, even to climbing down the embankment and bringing up an armful of ties. It is within easy remembrance of many of us that this was not impossible for the pole ties that we handled in our early days were small compared with our present standard 8-in. by 9-in. by 8½-ft. or 9-ft. creosoted ties. Compare the 56-lb. and 65-lb., 30-ft. rails of one or two decades ago with our 105-lb. and 115-lb. to 136-lb. rails of today and frogs and switches proportionably. We must consider that even if we had the old time trackmen and plenty of them, something more in the shape of machinery would be needed to handle these materials. No wonder then that at the present time, when that type of track man is gone and less than half the number of such as we have are available, we must turn to mechanical methods to accomplish our work. While machinery is not always economical, the fact that work can be done with less manual labor makes the use of those devices imperative.

Lifting Machinery

Let us first consider the uses to which the ordinary steam crane can be put. It will reduce labor, hazard and time, and will handle frogs, switches, guard rails and heavy switch timbers, will load and unload rails and should be more generally used for lifting in new rail, and lifting out the old, when rails are being renewed. We have had several elaborate reports on the practicability of laying rail in this manner, which makes any further description of this work unnecessary at this time. Among the newer devices that are rapidly being applied to cranes are magnets by which scrap, tie plates, angle bars, etc., can be picked up quickly and at minimum cost. Where the cranes are self-propelled, they eliminate the cost of any engine, except to get them on the scene of operations, reducing the cost accordingly. Clam shell buckets are now used to load cinders, clean ballast, and do various other kinds of work. Air hoists of many different designs with power supplied from the train line or from a compressor run by a gasoline engine are used for rail laying, and for loading and unloading material, the day having gone by when this work can be done by hand-driven machines.

Earth Moving Machinery

Would anyone care to go back to the days when we had to organize a gang of 35 men with rubber boots, picks, shovels, an engine and a train crew with flat cars to do ditching, when such equipment as the roadbed spreader and ditching machines are available? The new feature of the spreader is a ditching wing that can be set at any angle, by means of which the material is dragged out of cuts, the slopes and ditches shaped and drainage provided with the aid of only one or two laborers. For the same purpose the hoisting ditcher is adapted to slope a bank at any angle, cut to any depth and load the material excavated on cars, backing along the top of the cars as they are loaded. Comparative figures between ditching with the roadbed spreader and the hoisting ditcher are not available, but is is understood that, under certain conditions, the roadbed spreader is the most economical. This device, of course, has many other uses, as does the hoisting ditcher.

Ballast Machinery

Where ballast becomes so foul from cinders, sparks and dust that it becomes necessary to move and clean it, the only method that has been developed so far has been the use of the clam shell with large screens placed on a ballast car, with a hoist to pick up the ballast and drop it on the screen, the dirt falling in the car and the clean ballast going back between the tracks. It is, of course, understood that the clam shell can only take the ballast from between tracks or not very satisfactorily from the shoulder outside of the ties. If the ballast from between the rails must be cleaned, it must be shoveled out to either the side or center between tracks. Nevertheless this is a decided labor saving method of doing this work. Next in favor is the power-operated ballast screen which consists of a belt conveyor and revolving screen driven by a gasoline engine, which also provides power to move the machine along the track as the work progresses or from one job to another and can develop a speed of 20 miles per hour. This machine is so constructed that it can be removed from the track with about the same effort as a tie tamping machine. Stone to be cleaned must first be shoveled out from between the ties, and then shoveled into a long trough through which a belt is operated, conveying the stone to the revolving screen. The force to operate this device in an efficient manner depends on local conditions, the following being found to be the most efficient, with which about 96 ft. of track can be cleaned per hour.

1—Foreman.
10—men shoveling out in advance of the machine.
7—men placing the stone in the machine, three on the outside shoulder and four in the space between tracks.
1—man disposing of the dirt at the seven-foot line.
1—assistant foreman in charge of the machine and operating the stone chute.
1—machine operator.
1—flagman.

If the delay from traffic does not exceed 25 per cent of the actual time worked, the cost is about 15 cents per lineal foot of track cleaned or 45 cents per cubic yard of stone ballast. We read also of a suction machine having been constructed to remove this undesirable matter from stone ballast, but we have not sufficient information to describe its operation.

Where weeds growing in the stone ballast constitute the objectionable matter to be removed, a device is now made to be applied to the side of a car with machinery to raise and lower it, similar to a roadbed spreader. An A-frame is made into which steel teeth are set which can be adjusted to the contour of the center space between tracks or the shoulder outside. When this device is drawn at a speed of from 6 to 8 miles per hour, it roots up and renovates the ballast, letting any small particles go down in the ballast and making the surface look clean and fresh as new stone. This machine, run frequently,

saves much labor over hard weeding in stone ballast, but of course does not effectually clean it. It is suggested that a machine of entirely different type could be designed for the purpose of cleaning the stone ballast that would scoop up the stone into a conveyor, screen it and return the clean stone to the roadbed and at the same time load the dirt into a car.

For tamping ballast under the ties we have the pneumatic tie tamper which, while an acknowledged help in this class of work, is far from being the ideal machine from the standpoint of the compressor. We are glad to learn that designs are under way to build a perfectly balanced two or four cylinder compressor of much lighter construction which is not to be used for transportation as at present, with its large frame and platform. Track drills for turning nuts on track bolts, equipment to bore ties and timber and cutting and chipping tools are now available with these machines and are comparatively inexpensive, considering the savings that can be effected by their use. A mile of badly corroded nuts on track bolts can be cut off in four hours with two pneumatic rivet cutters, which work would require at least 12 men with chisels and sledges.

The latest feature of track work to receive attention is the lining of track. At least two devices permit us to throw track with less than one-half the men otherwise required. These devices will require some improvement yet to guard against lifting the track while lining it for otherwise the expensive operation of surfacing the track will be thrown away.

A. M. Clough, supervisor, N. Y. C., chairman; William Shea, general roadmaster, C. M. & St. P.; B. F. Hanna, supervisor, B. & O.; W. E. Davin, assistant roadmaster, P. & L. E.; F. H. Hanson, division roadmaster, G. N.; J. M. Fair, supervisor, Penn.; A. W. Tabert, roadmaster, C. & N. W.; William Lawrenz, supervisor, C. & E. I.; G. W. Morrow, supervisor, N. Y., N. H. & H.; E. P. Safford, supervisor, N. Y. C.; T. Thompson, roadmaster, A, T. & S. F., and J. W. Dahl, supervisor, N. Y. C.

Discussion

H. Ferguson (G. T.), described the laying of 87 miles of 100-lb. rail this summer at the rate of 1½ miles per day with 80 men, and a work train consisting of a rail loader, a coach and a small locomotive. By sending a gang ahead to do all adzing, tie plugging, etc., and using three men to place the rail in the track, it was possible with the rail loader to relay one side of a one and one-half mile stretch of track during the forenoon and the other half during the afternoon. Mr. Ferguson also pointed out that labor saving devices may often be used for a number of purposes other than that for which they are designed, as illustrating which he told how in building four miles of third track recently, a spreader had been used for almost every operation, including the stripping of a ballast pit as well as leveling the bank to grade prior to laying the rail. Again in an extensive ditching operation, at least $100 a day was saved by using a 4-ft. by 12-ft. platform upon which the excavated material was dumped and thereafter picked up bodily by the machine as it went along. W. F. Muff (A. T. & S. F.), reported good results with a rail-laying machine using a 12 hp. engine. By employing 60 to 75 men and having the full use of the track until noon, he stated that 90-lb. rail had been laid at the rate of 1 to 1¼ miles a day. The problem with this machine, he pointed out, was the inability to get enough men to keep up with it. The same condition, he pointed out, applies in the case of the ballast screen, in discussing which, however, he stated that it was found preferable on the Santa Fe to use 13 men when operating the machine rather than 7 men as outlined in the report of the Committee. It was his experience that the cost of screening ballast by this method was 65 per cent less than with forks while at the same time better results were secured and a saving made in ballast. J. W. Powers (N. Y. C), also took exception to the recommendation of the committee concerning the use of the ballast screen, stating that a flag man should be employed on each side rather than on one side only, and that a No. 19 train order should be issued to protect this machine while in operation.

H. B. Butterfield (N. Y. N. H. & H.), called attention to a riveting hammer now being tested out for driving spikes With four men setting spikes, two men operating hammers, and two men operating the power machine, he said that the machine has been doing work equivalent to the work of 20 men by hand and with less hazard. Enlarging still further on the discussion, Wm. Shea (C. M. & St P.), called attention to the practice now in use on his road in a limited way, of thawing out track with superheated steam, the method consisting of equipping a superheater switch engine with nozzles leading to each rail. The advantage of this method, he pointed out, lies in the fact that a yard foreman has the situation under entire control, it being only necessary for him to order the engine out on the work when he found it desirable.

Report on Maintenance of Light Traffic Branch Lines

THE maintenance of branch line tracks is of greater importance than most railroad managements realize. Few of the higher officers pass over these lines more than once or twice a year and the maintenance of these branch lines is left to the division officers.

Branch lines should be designated as A, B and C, according to the volume of traffic.

Class A Branch Lines

Class A branch lines include those with from seven to ten freight trains and four to six passenger trains a day, the freight trains operating at speed of 30 to 35 miles and passenger trains at 40 to 45 miles per hour. Class A lines have no limits as to weight of motive power, or of trains that can be handled. Locomotives may weigh from 125,000 lb. to 392,000 lb. While the cars of today are increasing in weight and are now stencilled for loads up to 150,000 lb. with a total weight of 193,000 lb., these cars are used on primarily ore and coal carrying lines and for the handling of stone, sand and oil field supplies.

Lines of this type should be laid, where possible, with new 90 lb. rail, second quality; or if this is not obtainable, they should be laid with good selected second hand 90-lb. rail, sawed or rerolled. New angle bars should be used when laying this type of rail because of the marked saving in the expense of maintaining the track after the rail is laid. Some managements have concluded that when rail of this type is laid, no ballast is needed or that the number of cross ties can be decreased materially. We should have 20 first class treated ties under a 33-ft. rail and if they are of soft wood they should be plated to carry the train loads. No less than eight to ten inches of ballast should be used. If gravel can be procured a bed of at least ten inches should be put under the ties, and where it cannot be procured first class cinders should be used for surfacing and to keep the

track up out of the mud. Too little stress has been placed on the necessity of putting enough ballast under the track to keep it from pumping mud and becoming rough. On descending grades where the rail creeps, a sufficient number of rail anchors should be applied to hold the rail from creeping and thereby avoid the unnecessary expense of spacing the ties under the joints each year. It is very expensive to have to space the ties each year where the rail creeps, to say nothing of having to drive the rail back sometimes three and four miles to get the proper expansion and to keep from cutting your rail.

The turnouts should be laid with the same weight of rail as the main track to the clearance point. They should be equipped with the proper braces and fastenings so that they will stay in place. All guard rails should be fastened to the running rails with heel blocks and clamps. In most instances enough good second hand tie plates can be picked up where new rail and tie plates have been laid on the main line to take care of this condition. A tie plate will add from three to four years to the life of a tie and will hold the rail to the proper cant so the wheel tread will cover its full face.

This class of line should have at least six men per section during the summer with sections not to exceed six miles in length.

Class B Branch Lines

Class B branch lines handle heavy loads with three or four freight trains, two passenger trains and two locals each way daily. A line of this character should be laid with good second hand 80 lb. or 85 lb. rail that has been taken out of the main track, where it can possibly be procured. Where there are gravel pits on the line it should have at least eight inches of gravel ballast under the ties and be dressed up to standard. It should have at least 20 ties to a 33-ft. rail. If the ties are treated they should be tie plated and at least all curves on such a line should be tie plated. Second hand tie plates should be taken from the main line where available. If not, new tie plates should be applied. Where the heavy traffic on such lines is in one direction, rail anchors should be applied to keep the rails from creeping.

On a line that has come to the attention of the committee where 52 lb. rails were relaid with 80 lb. rails, the management thought the track required no ballast after the heavier rail was laid. In spite of the fact that section forces were increased to nine or ten men to the section, the line could not be kept in surface and during the wet season derailment after derailment was caused by speed or poor surface or both. Finally the line was ballasted with good gravel and the trouble ended.

Class C Branch Lines

Class C lines carry very light power with two passenger trains, two local trains and possibly a pick-up train a day. Such lines are frequently laid with 52 lb., 56 lb. and 60 lb. rails. Although the traffic is light, the light rails and poor ballast invite derailments. Such lines should be laid with relay 80 lb. rail to save maintenance and avoid derailments.

Although local trains will handle only 18 or 20 cars, they will include hopper gondola cars of coal weighing as much as 185,00 lb. Such cars will cause the light rails to turn over and cut down into the track ties and in the course of six or seven years soft ties are about cut through and must be renewed; the rail has become kinked, surface bent or line bent on account of the poor ballast and the expense of maintaining such a track is heavy as the section forces will have to pick up the track constantly to keep it in riding condition and to keep the trains on the rails. On the other hand, good second-hand 80-lb. rail laid on 16 ties to a 30-ft. rail would save 320 ties to the mile. Also about nine per cent of the ties in the track are changed out every six or seven years on account of being cut almost in two with the light rail and the elimination of this form of failure would add four years of life to 288 ties in the track.

We have a record on such a line where four or five derailments occurred which required the wrecker to rerail the cars at a cost of about $840 for the wrecking outfit. With heavier rail the maintenance force on such sections could be cut from six to four men which would mean an annual saving of about $950 a section.

The replacement of 52 lb. rail with 80 lb. rail adds 44 tons of steel to the mile. This, at $22.50 a ton, would mean an expenditure of $990 per mile.

We should not overlook the fact that the railroads are constantly placing heavier power and equipment on their main lines and transferring their lighter equipment to branch lines and that the maintenance of way department is not keeping pace with the transportation and mechanical departments in the construction of its tracks on these branch lines.

During the summer a section foreman should spend at least one day a week in going over his section, picking up low spots and lining any portion of the track that may need attention. During the winter period of heavy storms when snow plows pass over the line, a foreman should be allowed enough men to clean the snow away quickly, taking them off as soon as the track is clear.

Sections on Class "C" branch lines should not be over eight miles long and should be equipped with motor cars.

During the winter when cinders are plentiful at the roundhouse, they should be taken to the branch lines and a few extra laborers given to the sections to unload them, until the sections are covered with sufficient cinders for a raise of at least six inches. By keeping this practice up from year to year it will be only a short time until such branch lines are entirely cindered. This will result in great economy in the cutting of grass and the mowing of weeds along the ballast line, as cinders will keep down the weeds and grass growth occurring along the track.

Track of this kind can be handled during the summer with three or four section laborers if there are not too many ties to be applied, or too much surfacing to be done. In the winter two men with the foreman can take care of such track.

On such branch lines, all ditching should be done with a mechanical ditching device and where this cannot be done, teams with scrapers should be used to clean out ditches and shape them for the winter. During the month of October, section forces should have completed the summer work so that they can see that all fences are in proper shape for the turning in of stock, set up snow fences to take care of the winter storms and do such light cleaning of ditches as may be necessary, such as burning them out and trimming them up so there will be a free flow of water. They should then go over their sections and drive down the spikes and tighten bolts.

W. F. Muff, roadmaster, A. T. & S. F., chairman; E. W. Gulley, roadmaster, C. R. I. & P.; J. W. Ellis, division roadmaster, St. L. S. F.; D. V. O'Connell, roadmaster, C. & N. W.; J. F. Butcher, general roadmaster, F. C. I. de C. A.; J. H. Goss, G. N.; F. M. Barnoske, roadmaster, C. M. & St. P.; P. Burns, roadmaster, C. M. & St. P.; J. R. Branley, roadmaster, M. St. P. & S. S. M., and William McGregor, roadmaster, M. St. P. & S. S. M.

Discussion

Objection was raised to the use of second quality new rail, in the proposed standards for Class A branch lines, several speakers calling attention to the fact that

this class of rail can very well be used with entire safety on the up-hill tracks, or main tracks through yards and terminals on the more important lines of a system. A point was also made of the fact that the weight of rail used on branch lines is dependent very largely on the quantity and weight of rails released from the main tracks of the more important parts of the system. J. W. Guffey, (S. A. & A. P.), described a short branch line forming a part of his subdivision which is being maintained effectively with rail weighing only 50 lb., as an illustration of what can be done with standards much lighter than those recommended by the committee. In answer to a question by President Corcoran as to the number of ties used, he replied that they were spaced as close together as was practicable and still make it possible to shovel tamp them.

An illustration of the committee's conclusion with respect to the decreased cost of maintenance with an improvement in track standards on branch lines, was afforded in the discussion concerning the Cedar City branch of the Chicago & Alton in Missouri. According to M. H. Murphy, (C. & A.), this 50-mile line was formerly laid with 60-lb. rail on soft mud ballast, and during periods of heavy rain it was almost impossible to keep trains on the track, while an average of eight men were employed per section. About three years ago the rail on this line was renewed with 80-lb. relayer rail and line throughly ballasted with cinders. As a consequence, the track is readily maintained with four men per section in summer time and two during the winter months, while the number of derailments is inconsiderable as compared with the track before rebuilding.

Reducing Injuries Among Trackmen

By H. M. MAYO
Superintendent of Safety, Southern Pacific Lines, Houston, Tex.

AS a brief preamble to my remarks I wish to assure you of my cordial appreciation of the opportunity afforded me to present my views on some of the factors of your work having to do with the safety of the men in track, and bridge and building occupations upon our railroads. If I could have presented these views in person, I would have gladly done so, but circumstances deny me this pleasure and I am therefore compelled to address you in an impersonal way, yet feeling that I shall have your sympathy even though I should be so unfortunate as to fail to develop new or untried angles in the matter under consideration.

No work in which human beings are included may be considered as efficient unless the factor of safety is a fundamental principle and one engaging the attention of all supervisory officers, who must at times be prepared and willing to subserve other conditions and considerations that the well being of their men may be maintained. The word "efficiency" has been long a synonym of harmonious and well directed effort. It suggests a finished product in which all of the elements of production have been centralized and all useless motion eliminated—units properly functioning, and results equalling the sum total of possibility.

Frequently this efficiency has been maintained without regard for expense as represented by actual money or by a depleted man power created by incapacity due to accident—the individual injury, often figured in as part of the day's work and a feature of the job. Such efficiency, possibly set down on a percentage basis, however, is not a correct estimate, for any method of reckoning which does not show safety as an active element and one which practically takes precedence over all other items, is an incorrect assumption and does not represent the facts.

I am of the opinion, however, that, whatever may have been the case in the past, the present periods are characterized by a determined effort to ameliorate working conditions in maintenance circles, so that by a combined effort, housing, sanitation, devices, tools, hours of labor, wages and working conditions are gradually being improved with a coincident reduction of casualties caused by any or all of the factors suggested, while methods based upon practices properly determined are curing many evils of an individual nature.

I am inclined to believe that the character of supervision is largely reflected in whatever freedom from accident a particular gang enjoys. So too the opposite—that an undue number of avoidable injuries to the employees reflects upon the supervising officer. This may not appeal to you, but the records will bear me out, for it is a fact that the foreman who permits careless practices on the part of his men; who encourages slip-shod methods by a failure to correct manifest negligence on rule violations, will show the greater number of personal injuries and loss of time. An examination of records will show that some foremen have few or no reportable injuries, while others are quite the reverse. Measure the results by methods and the answer will probably be revealed.

Therefore we must look to supervision generally in all departments of maintenance for a reduction in the thousands of unnecessary injuries that now clog the records of the Interstate Commerce Commission and that mar the history of accomplishment as applied to the various departments of railroad operation. You men who supervise may not escape the direct responsibilities which are undoubtedly yours and any lack of interest on your part will more than likely be followed by a corresponding failure on the part of your subordinates.

There are of course certain elements which do not come directly within your authority. Operating sections on some lines are much longer than on others; on some, track elevation and curves are predominant; again others are on tangents and level, and still others are in dry territory while many are compelled to combat long wet seasons or fight washouts. Climatic conditions are factors and so too the character of the employee. Men vary, and as they vary in race so too do they vary in stamina, courage and disposition. Some are wrought upon by trifling injuries and others are not impressed either by the character of such an injury or the opportunities for a brief vacation on half or full pay which the bruise or sprain may present. These are phases difficult of solution.

A cursory study of statistics presented by the Interstate Commerce Commission reveals some interesting features. One finds that on some well regulated lines the man-hours per injury in track and bridge and building work far exceed the records of the lines equally well operated, working under similar conditions and employing the same class of men. The question then involved is as to the character of supervision and the extent to which the roadmasters and foremen have assimilated the real principle of safety and the degree of time and interest they devote individually and collectively to the education

of their men in safe practices and the use of safe and adequate tools and appurtenances.

Decrepit tools and appliances are continued in use because of the trouble necessary to get new ones or to make the old ones good; unsatisfactory methods are permitted to remain in effect because they often represent the line of least resistance as compared to the labor of educating the worker, many of whom are new men since the labor turnover is large in unskilled ranks. To this turnover is undoubtedly due injuries that the old men sidestep by experience, for it is a fact that in gangs made up of men long on the job, months will elapse without a reportable injury while the reverse is true with gangs, the personnel of which is constantly changing during the season.

It is our experience on the Texas and Louisiana lines of the Southern Pacific, that the majority of the injuries in maintenance are caused by handling material, ties and rail, falls of persons and of course injuries received in handling and operating hand, motor and push cars. The relation of the man to the injury in almost every case is clear for in the majority of instances, he is chiefly the agent or arbiter of his own misfortune and the injury might have probably been avoided if carelessness or negligence had not been present. The element of ignorance is often included, but proper supervision and a few lessons from the foreman could largely decrease this factor.

In conclusion, I shall make no attempt to introduce any statistical angle in this brief paper, for figures do not always represent facts. I know you are glad that I do not, but I must refer again to the crux of the whole subject, which is education; first of the supervisor, then of the units making up maintenance forces. This must include everyone to become effective, but more particularly shall it gather within its protecting wings, the men actually on the job—the roadmaster, and bridge and buildings, extra gang and section foremen. Safe methods are quite possible, as experience has determined the unsafe ones, and they will vary according to conditions. Every possible effort is justified in order that we may better the condition and safety of the thousands of our people associated with the maintenance of our railroads, a work, the importance of which is second to no other feature of our operation.

Discussion

This paper brought out an active discussion of the methods in effect on various roads to reduce the number of injuries to track employees. William Shea (C. M. & St. P.) emphasized the influence which wide variations between the classes of labor, the character of work and climate exert on the accident record. For this reason, he advocated placing the responsibility for the reduction of injuries on the division superintendents who are most familiar with these local conditions and best able to meet them. J. W. Powers (N. Y. C.) referred to the large proportion of accidents arising from the operation of motor cars and stated that it was his practice to require all motor cars to slow down to six miles per hour when crossing highways and turnouts. He also advocated the installation of gongs or bells on motor cars. Other roads were reported to require their cars to come to a full stop before crossing highway.

P. J. McAndrews (C. &. N. W.) described the difficulty in reaching track forces with safety campaigns because of the fact that so many of them are located at isolated points. To overcome this handicap he has developed the practice of distributing certain bulletins of the safety department relative to maintenance of way accidents to all of his foremen. He also described his practice of sending a weekly letter to each foreman in which he incorporates a paragraph on some phase of accident prevention. He requires his men to stop their cars and dismount when meeting trains moving in the opposite direction on double track lines.

Securing the Maximum Life From Ties

By S. D. COOPER

Assistant Manager Treating Plants, Atchison, Topeka & Santa Fe, Topeka, Kans.

ALL of our cross ties are inspected at the point of origin and we have no reason to complain about the quality. When the ties are received at the treating plant they are stacked for seasoning, as it is the practice on the Santa Fe to treat nothing but air seasoned material.

When ready for treatment they are loaded up and put through an adzing and boring machine, which adzes a place for the tie plate, bores the holes for the spikes and also cuts off about ¼ in. from each end of the tie. This machine then stamps the kind of wood and weight of rail for which the tie is bored on one end of the tie, and the kind of treatment and the year treated on the other end. Cutting off the end of the tie in this way really gives us another inspection as we sometimes find indications of rot after the cut is made which it would otherwise be impossible to detect and these ties, of course, are culled. After the ties have been treated they are again stacked for about three months seasoning before being shipped out, We place much importance on this feature, as we know that we get longer life because of following out this practice.

Our ties are ordered and distributed according to a plan which provides for each species of woods to be used in definite localities for each class of track. For example, it provides for hardwood ties to be used on all curves of two degrees and upwards, wherever located, and softwood ties, such as native pine, Oregon fir, New Mexico pine, and redwood, to be used on tangents in the various districts to which they have been assigned. When the ties are inserted in the track the instructions are that each tie must have a tie plate, and these instructions are followed very carefully. The plate is 7½ in. by 9 in. and practically covers the face of the tie.

A dating nail is placed on every tie inserted; a round head nail for a treated tie and a square head nail for an untreated tie. This nail bears the year of insertion and is placed on the top of the tie about half-way between the end of the tie and the rail. These nails not only provide a ready means of identifying the year of insertion, but are of great value in other ways. A section foreman will invariably give a tie of comparatively short life a much closer inspection before taking it out of the track than if there was no nail showing its age.

Commencing in 1904 we started to keep a record of all ties inserted in the track on all parts of the system and continued this until 1910 when we found that it did not work out satisfactorily. So in 1910 an experimental section was established on each superintendent's division, the sections being selected to represent conditions in the territory and each one being a regular track foreman's section. These sections are carefully checked each year by representatives from the manager of treating plants'

office and a report of this inspection was sent to all the operating and maintenance of way officers concerned, as well as to the chief engineer system, and assistant chief engineer system.

In addition to these experimental sections we have several sections of track where ties have been laid out of face and where we keep a close record of the life of the ties. By these means we are able to keep a very close and accurate record of the life we are getting from our ties—a record of our ties inserted in the regular practice of spotting in and also a record of the service given by ties inserted out of face.

In addition to this check on our methods we have inspectors with motor cars who inspect all released ties found on the right of way. On these inspections, they are accompanied by each roadmaster over his territory, and a report is made daily of the ties inspected, giving the year of insertion when possible, and the cause of removal. A copy of the report covering each superintendent's division is sent to the general manager, the superintendent of the division, and the chief engineer of the system. When these inspections were first started some years ago, we found quite a number of ties had been removed that should have remained in the track, but now we find very few on the right of way that should not have been removed from the track; this is entirely due to the intelligent and whole-hearted support of everyone concerned.

The question probably arises as to whether such an organization is profitable to the railroad. I think of no better answer than the following as I think the figures speak for themeselves: In 1885 we treated 111,503 ties. From 1885 to 1922 we treated 70,499,756 ties. This, I think, demonstrates beyond all question that one management is satisfied that the treatment of material is economical.

As to specific results, I will refer to one section of ties laid out of face near Melvern, Kans., on our Ottawa cutoff, which carries, possibly, the heaviest traffic on the Santa Fe system. In 1906, 24,238 hewn Texas pine ties, treated with creosote by the Rueping process were inserted in this section. In 1922 our annual inspection showed 833 ties removed, and only 3 of them on account of rot, the balance being taken out for other causes. Thus the life given by these ties up to the end of 1922 was 15.97 years, and from the present appearance of these ties, I will be very much disappointed if we don't get an average life of 20 years.

In 1898, the Santa Fe System—then a line 8,185 miles, used 336 ties to the mile. In 1922, with 17,104 miles of track we used 158 ties to the mile—less than half as many ties inserted per mile in 1922 as in 1898. Below is a statement showing the average number of ties inserted on the Santa Fe from 1898 to 1922 inclusive, which shows how the renewal requirements have gradually declined.

Year	Total Miles	Total Ties Inserted for Renewals	Total Ties Inserted per Mile
1898	8,185	2,751,849	336
1899	9,028	2,246,250	249
1900	8,804	1,687,537	192
1901	9,368	1,557,866	166
1902	9,557	1,955,093	205
1903	9,768	2,352,502	241
1904	10,237	2,770,306	271
1905	10,885	2,788,378	256
1906	11,637	2,291,997	197
1907	11,694	3,365,017	288
1908	12,169	3,667,181	301
1909	12,601	3,691,623	293
1910	13,379	3,758,984	281
1911	13,889	3,781,745	272
1912	14,488	3,252,061	224
1913	14,766	2,863,839	194
1914	15,293	2,753,842	180
1915	15,409	3,234,760	210
1916	16,151	3,118,941	193
1917	16,276	2,483,651	153
1918	16,554	2,456,599	151
1919	16,711	2,302,952	139
1920	16,924	2,753,673	163
1921	16,933	2,514,325	148
1922	17,104	2,693,905	158

Discussion

The discussion of this report centered largely around the advisability of eliminating all adzing of ties in track. In reply to a question, Mr. Cooper stated that the ordinary adzing of a treated tie would probably reduce its life one-half. A number of members referred to the practice of "rolling their rail in" by adzing the ties to overcome the tendency for it to turn out under traffic. Several members referred to the value of tie plates of adequate size and with sufficient projection on the outside of the rail to counteract this tendency. The use of inclined tie plates was also commented on favorably in this connection.

Answering the Railroad Critics

By F. W. SARGENT
General Solicitor, Chicago & North Western, Chicago

THE Track Supply Association gave a dinner to the members and guests of the Roadmasters' and Maintenance of Way Association on Wednesday evening at which approximately 425 were present. Following the dinner, Mr. Sargent spoke on the railway situation in part as follows:

A convention was held recently in Chicago, called ostensibly to attack the work of the Interstate Commerce Commission with relation to the valuation of the railroads. It was composed almost entirely of men who have been prominent in advocating the government ownership of railroads.

Our "friends," who use the railroads as political vehicles, first claimed that the value of $18,900,000,000—as found in Ex Parte 74—was based solely on the property investment accounts of the carriers. Later they learned this was not true and that in fact the value was determined by the data and studies made under the La-Follette valuation law.

They next charged that the valuation was based on war time prices—and later learned that it was based on unit prices at and prior to 1914.

Then they claimed that the value should be determined by the market value of stocks and bonds as quoted on the New York Stock Exchange at the close of the panic year of 1921. But the Supreme Court of Mr. LaFollette's state has recently answered this fallacious theory by stating that "In determining the present fair value of the property of a public utility for rate making purposes, but little if any weight can be given to capitalization of earnings or to stock and bond values for the reason that these are dependent almost entirely upon the rates charged, the reasonableness of which is the very subject under investigation."

The real proposal of those who are criticizing the Interstate Commerce Commission, under the pretext of wanting "original cost to date" is, when analyzed, merely a demand for valuation based upon the reproduction theory. That is to say, their argument is one which asks for a reproduction of the existing property less depreciation and that the basis of reproduction be upon the unit prices for labor and material as these prices existed during the various periods that a given railroad has been developed.

The LaFollette law requires the commission to take into consideration three important elements, one of which is reproduction new; another, reproduction less depreciation; and another, original cost to date. The commission under its present plan only makes an inventory of and values the actual physical property as it now exists. And the commission fixes its value upon the unit prices as they existed over a period averaging twenty years prior to 1914.

An analysis of the arguments advanced shows that the real difference they claim is the difference between $18,900,000,000 found in Ex Parte 74 and a value of $13,000,000,000 based by some upon quotations of stocks and bonds on the New York Stock Exchange in 1921 and by others at a running jump guess, based upon nothing more tangible than the popular misconception which existed years ago to the effect that the railroads were over-capitalized. The difference arrived at in this manner is something less than seven billion dollars.

Now if our political "friends" should ultimately succeed in confiscating the seven billions of railway values alleged by them to be the excessive value included within the findings of the Interstate Commerce Commission, how would it benefit the men and women who pay the freight and passenger bills of the country? In the first place it would, of course, destroy the credit of the railroads. But laying this aside, what would the practical result be on the freight and passenger bill of the country?

In the last three years since the termination of Federal control, the railroad companies as a whole have not earned 5¾ per cent on even $13,000,000,000 nor on $12,000,000,000. Therefore, the value of $18,900,000,000 has had nothing to do with the level of freight and passenger rates.

Let us assume, for the purpose of argument, that the small coterie of radical politicians who seem to confine their operations entirely to the subject of railroad values, should succeed in confiscating seven billion dollars thereof, what would it amount to in the reduction of freight and passenger rates?

A return of 5¾ per cent on seven billion dollars equals $402,500,000. This may be conservatively estimated to be something around six per cent of the total freight and passenger bill of the country for 1923. Therefore, assuming that the railroads will earn 5¾ per cent on $19,000,000,000 in the year 1923, which in all probability they will not do, and assuming that the railroads refunded to the people 5¾ per cent on all above $12,000,000,000 or refunded to the people 5¾ per cent of $7,000,000,000, it would mean a refund, or in other words, a maximum reduction in freight and passenger rates of something like six per cent.

Now, let us apply this reduction concretely. First, as to grain. Let us take, by way of illustration, the rate on corn from Ames, Iowa, to Chicago, which is 10.36 cents per bushel. If you reduce this by six per cent you have saved to the farmer about seven mills per bushel.

Let me give you another illustration: At the hearing before the United States Labor Board in 1921, there was introduced in evidence, by those representing the unions, a table prepared by Professor Jaffa of the College of Agriculture of the University of California, showing the amount of food required by a family of five to support them in health and comfort for a month. The total number of pounds contained in the table is 502.

I took this table and then hauled the various items referred to therein great distances—the fresh meats from the Missouri river, fish from Duluth, eggs from the Missouri river, flour from Minneapolis, rice, sugar and coffee from New Orleans, fresh vegetables and deciduous fruits from California, butter from Marshfield, Wis., potatoes from Princeton, Wis., oils and fats from the Missouri river. And I applied to the various items contained in the table the existing freight rates and by so doing found that the total charge for all the food required for a family of five in the city of Chicago for the period of a month, so far as freight rates are concerned, comes to $2.70, or 54 cents per person. If you reduce this 54 cents per person by six per cent, which it is claimed could be done by confiscating seven billion dollars of railway values, you would save each person in the city of Chicago, assuming that all of his food came from these great distances, enough each month to enable him to buy 3¼ sticks of Wrigley's Spearmint chewing gum.

The question, therefore, arises—what can be done to reduce freight rates? Personally, I think the answer is obvious.

The first thing to do is to stop the political and demagogic agitation which is aimed at the destruction of the credit of the railroads and also has a tendency to destroy the morale of employees, and even at times create mutiny in their ranks.

The second thing to do is for our regulating bodies to put a stop to technical restrictive and repressive regulations that interfere with initiative in management.

The third thing to do is for those charged with the duty of taxing the railroads to come to a realization that every time they make the North Western, for instance, pay $6 out of every $100 for taxes, that this $6 comes out of the shippers, for the railroad has no other way of collecting. It is an abnormal condition to find that the railroads are paying more in taxes, and have for the last three years, than they are able to pay to their owners for return on the investments of these many people in railway stocks.

The fourth thing to do is to realize that our transportation systems are national in character and that there is no longer any reason for fixing rates by geographical lines. Rates should be based upon industrial and commercial lines, without reference to state lines.

The fifth thing to do is for our people to come to a realization that the return on capital plays an infinitesimal part in the cost of the freight and passenger bill of the country, and that rates should be so adjusted and maintained that capital may be attracted into railway service at the lowest possible rates and in such liberal quantities that mechanical and physical improvements can be made rapidly to take the place of labor wherever possible and thus reduce the cost of operation. The opportunities in this line are almost unlimited. Enormous reductions in expenses can be made by reducing grades, strengthening bridges to carry heavier motive power, enlarging railway terminals, improving shops and installing mechanical devices.

The time is here when if our transportation systems are to expand and grow with the progressive development of the country and rates be maintained on a basis reasonably satisfactory to all, we must take our railroads out of the realm of shallow political discussion and deal with them in a practicable business-like way,

and so conduct public regulation that management may have an opportunity to function somewhat as it does in other lines with rates maintained on a basis that will attract and reward capital and thereby enable improvements to be made that will produce the necessary economies in the cost of maintenance and operation.

The Maintenance of Track Joints

By R. S. COCHRANE
Engineering Department, Atchison, Topeka & Santa Fe, Chicago

THAT rail constitutes, next to ties, the largest item of expense in the track structure goes without saying. It is equally true that its life is limited by the deterioration at the joints rather than by wear throughout its length. It is a strange anomaly, after all these years of concentrated effort, of double distilled wisdom, filtered and refiltered through the fine screen of experience, that the charge should be made and admitted within limitations that the joint and not the rail fixes its life.

The joint occupies a fraction over six per cent of the length of a 33-ft. rail. It is rather well believed that failures at the joint are in excess of this proportion. On the Santa Fe system where 90 lb. rail is the heaviest and joints are given its standard attention, the percentages of rail failures at the joint for the periods given are as follows:

Year	Total Failures	In Joint	Per Cent
1921	1,853	238	12.8
1922	1,765	107	6.06
1923 (8 months)	1,854	63	3.4

A recent canvass on the Santa Fe showed that our joint ties possessed a life of approximately 70 per cent that of intermediate ties so that here again the joint gathers toll. Interpreted into money and considering only the two ties involved at the joint, this means an untimely loss of $2 per joint or $320 per mile every five years, based on a life of 16 years for intermediate and 11 years for joint ties at 20 cents per year. Bear in mind that these ties are creosote treated after being bored and dapped.

Slot spiking for anchorage accelerates both mechanical wear and decay, the remedy for which may be found in part in rail anchors. Tie spacing—uniform, non-uniform or special, with as many varieties of demands on the joint, all intended to assist and render equal or improved service, is still a problem. For our line I plead guilty of all three methods. Another problem is the control of expansion. Highly abnormal maintenance with far reaching effect on elements not otherwise effected may result from improper handling. The joint may be made to well play its part in holding expansion.

In looking back it appears that the bolt has been overlooked, its duty considered, as an indispensible aid in joint maintenance. Poor bolts have contributed more to your troubles than poor joints. The deduction at least may be made if rail wear is dependent upon joints, and joints in turn on bolts, then the main dependence of rail wear is on bolts.

Specifications for bolts adopted by the American Railway Engineering Association provided for 75,000 lb. yield point and 100,000 lb. ultimate strength, heat treated and quenched bolts carrying an increase in strength of 100 per cent (which cost six per cent additional to produce)—an epochal event since with the heavier and stronger design of joint bars coming into use, the heat treatment of which soon followed, it marked the point where the maintenance of this so-called weak link in the chain, the joint, in the desired degree of tightness, was for the first time a possibility.

With the knowledge of the benefit reaped from the former changes, the American Railway Engineering Association revised its bolt specification last March, to increase its elastic limit from 75,000 lb. to 85,000 lb. and its proposed ultimate strength from 100,000 lb. to 110,000 lb. for heat treated bolts which makes more certain the possibilities of better joint maintenance that are to be developed.

At the same session there was also adopted a schedule of track wrench lengths proportioned for the strength of the untreated and treated bolts. The provision of a better bolt with nuts thickened in proportion was a real accomplishment and it would seem that the problem was again solved since we still retained the long wrench and a strong back. The change to a better bolt, however, cannot change the natural characteristics of track, evidenced by its flexibility and elasticity so productive of wear throughout.

In general wear is a product of friction through movement superinduced by and proportioned to looseness. Stronger bolts alone will not completely return to either a strong or a weak joint its full measure of strength by arresting looseness or wear, unless maintained continuously and uniformly tight, which condition is not accomplished with hot riveted bolts, positive forms of nut locks or periodic tightening, for it is in the interval between tightness and losseness that the greater damage is done.

B. M. Cheney, in an article in the February, 1923, issue of *Railway Engineering and Maintenance*, summarized in their relative importance the answers made to the query, "What is the purpose of a Nut Lock?" as follows:

"To prevent nuts from turning back.
To preserve sufficient threads on the bolt to permit future tightening.
To provide leeway so that nuts can be loosened in hot weather to allow contraction and expansion of the rail.
To reduce vibration or friction."

It is correctly stated that the ordinary nut lock exerts a maximim pressure of about 3,000 lb., as in all spring members this pressure diminishes with reaction. Reverting to the revised specifications of the A. R. E. A., covering track bolts, it is evident that an adequate bolt of 1 in. diameter should be capable of withstanding an actual applied load of approximately 27,000 lbs. If such a load is applied, is it not desirable to retain such a load automatically. If not, why apply it initially?

That we do not stop with this 3,000 lb. pressure, accounts for bolts being stressed or broken in tightening or in tightening plus traffic with the common result that wear in rails, joints, ties and ballast is magnified and deterioration is hastened. In the article referred to, attention is called to the fact that increased strength in bolts, calls for an increased means of preserving tightness, since the stronger bolt makes the ordinary nut lock less capable. It was pointed out that nut reversal for which the nut lock was originally devised is now incidental and the main need is spring pressure proportioned to the intensity of pressure applied on the bolt through wrench or traffic load to prevent initial

wear of jointed parts and to compensate for recurring wear due to inadequate track supervision—in other words, to retain in so far as is possible the initial security of track joints. To quote from a footnote in the A. R. E. A. specifications of 1915, for nut locks, "That amount and durability of reactionary power under constant pressure is the true test of any spiral nut lock." In March, 1923, the A. R. E. A. revised its specifications covering coiled nut locks, and changed the name to coiled spring washers to include the higher pressures specified for these accessories without their flattening.

There is no doubt that the adoption and use of spring washers conforming to these specifications will not cure all of the joint ills from which we suffer, since we still have ties and ballast as the support for our track, and it will not improve the quality of the rail, but it should effect a distinct saving in the ills attending loose bolts, loose joints, loose ties and battered end rail, and restore that uniformity of surface attending the greater approach to the continuous rail.

The Condition of the Railroads and Their Betterment

By W. G. BIERD
Receiver, Chicago & Alton, Chicago

WHAT is the present condition of the railroads? What is the cause of this condition, if the roads are not in proper condition? Again, what should be done for their betterment? There is no question in any man's mind but that the railroads of continental America must be improved, and that the transportation system of the country as a whole must be expanded to meet the growing demands of the public. We may say without hesitation that the roads and their equipment have been weakened, during the past few years, so that they have not been in their full strength to conduct the transportation required by the country as a whole.. The real and greatest troubles which the railroads have undergone during this period of time have resulted from a complete readjustment of railroad conditions.

For some time there were certain sections of the country, particularly the rural districts in which there was an ever-increasing demand for Government control of the railroads. The people were unaware that they had the best and cheapest transportation in the world. They thought it should be better, and that they should pay even less for their service. So Congress and the administration were being pressed by the growing demand from the people, and these governmental bodies were susceptible to this growing influence, so that when the war came the opportunity was seized upon to take over the railroads.

During this period of government control, men high in the authority of the government undertook to change the entire administration of railroads, to change a system that had been 50 years, yes 70 years, in its making. As for myself, I saw as clearly then as I do now what the result would be.

The first appearance of these wrongs occurred in a complete breaking-up of the harmonious organization that existed on the railroads; employer and employee were divorced. Competition between systems or roads and between men practically ceased, the thought being that these railroads could be operated under one universal rule, where every man and every system should be equal.

Disturbances followed in the form of local and general strikes. Men gave less effort, and the whole-hearted interest that had been devoted to the properties for years was lacking. Thus the railroad properties as a whole declined until the transportation system of this country became weakened. But if the railroad employees and the public at large were profiting by this, it would have been all for the best, but now that we can look back, and review the situation, we are certain that the people as a whole and the railroad employees as a whole have not prospered by these conditions, and their general state of contentment and their general state of prosperity are not as sound as they were before these conditions prevailed. The people as a whole slowly, but definitely learned this, and today the people who were clamoring for government control of the railroads realize that it is not for their good and that in the end they pay more than they should pay for the transportation service they require from the railroads.

If this is true, and I feel most certain it is, we must reverse the trend of affairs. We must work our way back to an equalized position with the rest of the world. From a railroad standpoint how can this be done? The producing people are already clamoring for reduced rates and the producing people are going to be heard, no matter what we say. We know also that our rates of carriage are the highest in the history of the American railroads. Therefore it is certain that railroad rates must be decreased or some means of reducing the cost of operation must be found. The eastern roads, so far in 1923, have returned to a fairly prosperous condition and can secure money to carry on their work, and improvements, but the western roads with few exceptions are suffering severely. Their securities are so depressed that it is very unwise to sell them in order to raise money.

What then is necessary to improve the railroads? We must begin to work our way back. First, we must remove the railroads from these political influences, because the railroad question has become and now is the paramount political question of the day, and just so long as our railroads are engulfed in politics and are influenced by politics, just so long will we have an unsound system of transportation. A few prosper, but the people as a whole will lose, and pay that which they should not pay, and yet your transportation system will remain in its weakened condition.

Much has been done since the roads were returned to their owners to improve conditions, and much more is to be done; but it is not being done on a sound financial basis, and we cannot hope to keep it there under the present conditions. To bring the railroads up to where they belong every man must realize that he owes a duty and a full honest day's work to the property he serves. In other words, we must all go to work as we once did. I am sure that every man present will admit that every institution must have mangement. You officers in the maintenance department are no longer in control of your department. The rules and conditions restricting you are government-made rules. Your duties were never so hard and discouraging as today. You know what is necessary to correct this, but you are helpless just as all other officers are helpless. There is one government body that says what our rate of income shall be. There is another government body that says what the rate of

pay and working conditions of the railroad employee shall be, and it is between these upper and nether millstones that the railroad management is struggling.

Your emplyee will say to you "I owe no allegiance to you; I recognize only other authorities, and when I disagree with you on my service, and rate of pay, there is a tribunal higher than you to which I will submit this question," and that tribunal is a government tribunal, influenced by all the political prestige that must necessarily follow such a condition as now confronts us.

Therefore, in your department which controls the physcial condition of the property—these conditions must be changed. You must be given authority to supervise your department, in fact as well as in name. You must know that you are securing an honest and fair day's work from every man for an honest and fair day's pay. The prices of materials necessary for you to maintain your railroad and expand and build additional tracks and new lines to serve the American people, must also be reduced to former levels; and just as we reverse these conditions and begin to move back to a sound competitive basis just so will we improve the properties and bring them to their full strength and reduce for the American people the present extravagent costs of transportation.

Other Features

ONE of the most interesting features of the convention program was a talk on Railroading in Siberia, by B. O. Johnson, assistant to the operating vice-president of the Northern Pacific at St. Paul, Minn., who spent five years in Siberia with the Russian Railway Service Corps. Mr. Johnson opened his talk with a graphic description of the Tran-Siberian railway and the country it traverses and of the almost inconceivable vastness of the plains of interior Siberia. Of particular interest to his audience was the excellent description of track standards and the railway operating organization, particularly as applied to track maintenance. Touching on the influence of government ownership and operation, he showed how wasteful were the methods used— that it was customary to renew all ties out of face every four years and to employ from eight to fifteen men to a section gang covering 2½ miles of double track line carrying very light traffic. The only redeeming feature of this extravagance was that the line was able to withstand five years of neglect without serious deterioration. Mr. Johnson closed his talk with some remarks on the physical and mental characteristics, of the Russian people, the economic conditions with which the Russian peasants, which comprise 90 per cent of the population, have struggled during the last five centuries and the effect of this condition on their attitude toward the Bolshevik regime.

Subjects Suggested for Study

The Committee on Subjects suggested the following topics for consideration during the ensuing year:

Laying rail and applying ballast on double track lines with single track operation;

The operation of work trains;

The disposal and utilization of cinders;

The distribution of routine maintenance of way material;

The possibilities of winter track work.

The report of the secretary showed that 50 members had been elected during the year and that the total membership at the end of the year was 1,170. The report of the treasurer showed a baalnce of $1,115.

Officers Elected

The following officers were elected at the annual business session on Thursday morning: President, J. B. Martin, supervisor, New York Central, Elkhart, Ind.; first vice-president, W. F. Muff, roadmaster, Atchison, Topeka & Santa Fe, Newton, Kan.; second vice-president, G. W. Morrow, track supervisor, New York, New Haven & Hartford, New Haven, Conn.; secretary, P. J. McAndrews, roadmaster, Chicago & North Western, Sterling, Ill.; treasurer, T. F. Donahoe, general supervisor of road, Baltimore & Ohio, Pittsburgh, Pa.; members of executive committee, M. Henry, supervisor, Chicago & Eastern Illinois, Villa Grove, Ill., and R. Haring, track supervisor, Long Island Railroad, Jamaica, N. Y.

New York was selected as the location for the next convention.

Following the adjournment of the convention on Thursday noon, approximately 150 members visited the plant of the Inland Steel Company at Indiana Harbor, Ind., where the afternoon was spent watching the manufacture of track bolts, spikes, tie plates, rail joints and rails. Through the courtesy of the steel company special opportunity was afforded the members to study particularly those phases of manufacturing operations which influence the material as used by the railway men, such as the straightening of the rails.

The Track Supply Exhibit

EVERY inch of available space was taken by the 61 firms participating in the exhibit of the Track Supply Association on the mezzanine floor immediately below the convention hall. This exhibit, which was presented for the twelfth successive year, has grown to the point where it is scarcely secondary in educational value to the convention itself.

The officers of this association, to whom the success of this exhibit is due, were as follows: President, F. M. Condit (Fairbanks, Morse & Co., Chicago); vice-president, J. J. Cozzens (Union Switch & Signal Company, New York City); secretary-treasurer, W. C. Kidd (Ramapo-Ajax Corporation, Hillburn, N. Y.); director ex-officio, Herbert T. Potter (vice-president, Wyoming Shovel Works, Wyoming, Pa.); advisory directors, E. T. Howson (editor, *Railway Engineering and Maintenance,* Chicago); and R. A. Van Houten (vice-president, Sellers Manufacturing Company, Chicago); directors, Alex Chapman (western sales manager, Rail Joint Company, Chicago); A. H. Told (general manager, Positive Rail Anchor Company, Marion, Ind.); K. J. Eklund (vice-president, Mudge & Company, Chicago), and J. Howard Horn (sales manager, National Lock Washer Company, Newark, N. J.) The list of exhibitors follows:

Exhibitors

Air Reduction Sales Company, New York; oxygen, acetylene and carbide, cutting and welding apparatus, radiograph and regulators; B N. Low, R. T. Peabody, C. A. Daly and F. Graneman.

American Chain Company, Bridgeport, Conn.; rail clamps, brace plates, replacers, rail benders, one-piece guard rail, compromise joints; J. J. O'Connell.

American Hoist & Derrick Company, St. Paul, Minn.; photographs of ditchers; Miss H. Holer and C. Hook.

American Steel & Wire Company, Chicago; woven wire fence, steel fence posts and galvanized steel fence posts; L. P. Shanahan, N. E. Evans, J. W. Collins, A. W. Froude, J. W. Patterson, J. W. Meaker and A. L. Waterman.

American Valve & Meter Company, Cincinnati, Ohio; switch stands and track appliances; J. T. McGarry, F. C. Anderson and Dan J. Higgins.

Balkwill Manganese Crossing Company, Cleveland, Ohio; model of an articulated manganese steel crossing; S. Balkwill.

Bethlehem Steel Company, Bethlehem, Pa.; switch stands, guard rail, gage rods; Neil E. Salsich, E. H. Gumbart, J. F. Hennessey, G. Riddle, J. S. Clark, J. H. Richards, C. A. Alden, J. C. Chandler and J. V. Honeycutt.

Blake Manufacturing Company, Mansfield, Ohio; V. G. portable flood light, soldering irons; B. W. Leonard and H. W. Armstrong.

Buda Company, Chicago; section motor car, switch stand, tool grinder, track liner, track drill, track jack; J. E. Murray, F. T. Connor, A. L. Bliss, H. C. Beebe, J. L. Artmaier and E. Conant.

Carbic Manufacturing Company, Duluth, Minn.; carbic lights, acetylene welding and cutting apparatus; A. D. Guthrie and F. G. Squire.

Chicago Malleable Castings Company, Chicago; rail anchor tie plate, tie plate with key, rail anchor tie plate with key, rail clips, bumping posts and literature; Warren Osborn.

Chipman Chemical Engineering Company, New York; photos of track; M. McComb and B. G. Thompson.

Creepcheck Company, Inc., New York; creep checks; A. J. Dinklage, P. E. Brown, F. Ragan and T. J. Farrell.

Crerar, Adams & Co., Chicago; bonding drill, track drill, rail saw, die starter, jacks, shovels, etc.; Russell Wallace, W. I. Clock, J. A. Martin and W. Reidell.

Duff Manufacturing Company, Pittsburgh, Pa.; jacks; C. N. Thulin and E. E. Thulin.

Electric Tamper & Equipment Company, Chicago; photos of electric tie tamping machine; C. Jackson, W. Adams, H. W. Cutchall and V. Cartier.

Elliott Frog & Switch Company, East St. Louis, Ill.; adjustable switch brace, guard rail clamp, adjustable clips, switch stand; H. J. Elliott.

Fairbanks, Morse & Company, Chicago; inspection car; E. C. Golladay, F. J. Lee, F. M. Condit, G. W. Lewis, H. L. Hilleary, D. K. Lee, J. L. Jones, E. E. Pendray, E. P. Chase, H. E. Vogel, C. G. Mahana, W. C. Dehn, B. S. Spaulding, C. B. O'Neill and P. H. Gilleland.

Fairmont Railway Motors, Inc., Fairmont, Minn.; light inspection car; W. F. Kasper, W. D. Brooks, S. D. Gibson and M. A. Evans.

Fleming & Son Company, J. R., Inc., Scranton, Pa.; switch point protector; A. J. Fleming.

Hauck Manufacturing Company, Brooklyn, New York; thawing outfits, kerosene torches, circular flame burners, venturi burners; W. C. Squire and C. P. Cogswell.

Hayes Track Appliance Company, Richmond, Ind.; derail and model showing in actual operation; H. J. Mayer, S. W. Hayes and H. Q. Hamilton.

Headley Good Roads Company, Philadelphia, Pa.; samples bituminous for road crossings, photos; F. X. Kern and W. T. Gilbert.

Idol Track Liner Company, Chicago; track liners; T. D. Crowley, F. R. Sinning and Mr. Franzen.

Indiana Piston Ring Company, Hagerstown, Ind.; light weight motor car, peddle car; Macy O. Teeter.

Ingersoll-Rand Company, New York; pneumatic tie tamper, pneumatic rail drill, pneumatic nutting machine, pneumatic shovel and pneumatic bonding drill; W. H. Armstrong, J. N. Thorp, Jr., and Charles Dougherty.

Jordan Company, O. F., East Chicago, Ind.; moving pictures; A. L. Greenabaum, J. S. Zuckerman and J. W. Bauton.

Kalamazoo Railway Supply Company, Kalamazoo, Mich.; motor car, track jacks, combination track gage and level; John McKinnon, F. E. McAllister and H. R. Miller.

Lundie Engineering Corporation, New York; tie plates, rail anchors; W. Brooke Moore, L. B. Armstrong and E. Brandeis.

Maintenance Equipment Company, Chicago; friction car stop, steel fence post, blue flag derail, photo of rail layer and photo of power ballast screen, switch point straightener, tie spacer; H. C. Holloway, J. A. Roche, E. Overmier and A. L. Arnold.

Mechanical Manufacturing Company, Chicago; all-metal bumping post; H. E. Johnson.

Morden Frog & Crossing Company, Chicago; rail, braces, switch connections; S. S. Withrow, W. J. Gilbert, A. C. Smith and H. H. Hartz.

Mudge & Company, Chicago; railway motor car engine; Karl J. Eklund, John M. Mulholand and J. K. Vanatta.

National Lock Washer Company, Newark, N. J.; spring washers and lock washers; J. Howard Horn, R. L. Cairncross and Stanley H. Smith.

National Malleable Castings Company, Cleveland, Ohio; model of wrecking hook, malleable iron washers, rail braces and tie plates; E. V. Sihler, T. Aishton, G. Faitz and R. Wright.

Northwestern Motor Company, Eau Claire, Wis.; literature and photos; A. H. Nelson.

Oxweld Railroad Service Company, Chicago; oxy-acetylene welding and cutting equipment; W. H. Kofmehl, L. C. Ryan, F. C. Teicher, Fred Lurquin and H. R. Wehner.

P & M Company, Chicago; anti-creepers; S. M. Clancy, D. T. Hallberg, John Gallagher, Max Ruppert and J. E. Mahoney.

Pocket List of Railroad Officials, New York; copies of publication; J. Alexander Brown and Harold A. Brown.

Positive Rail Anchor Company, Marion, Ind.; girder type guard rail, rail anchors, rail braces, guard rail plates and braces and tie plates; A. H. Told and L. C. Ferguson.

Q & C Company, New York; one piece guard rail, guard rail clamp, compromise joint, derails, steel fence post, car replacer; R. J. McComb, J. L. Terry and Lewis Thomas.

Rail Joint Company, New York; insulated joints, compromise joints, standard joints and track liner; Charles Jenkinson, R. W. Payne, Alex Chapman, G. T. Williard, C. B. Griffin, J. N. Meade, W. E. Gadd, Milton Markley, E. A. Condit, G. H. Larson, V. C. Armstrong, C. A. Disbrow and T. Ryan.

Railroad Supply Company, Chicago; tie plates; E. H. Bell, H. G. Van Nostrand, W. S. Boyce, A. H. Smith and J. C. Durancean.

Railway Purchases and Stores, Chicago; copies of publication; Edward Wray and J. P. Murphy, Jr.

Railway Review, Chicago; copies of publication; C. H. Gertner, D. T. Stillman, G. E. Boyd and L. R. Wolf.

Ramapo Ajax Corporation, Hillburn, N. Y.; automatic switch stand, double shoulder switch plate, manganese guard rail, guard rail clamp, adjustable rail brace, forged braces; J. B. Strong, W. C. Kidd, R. J. Davidson, Jr., D. F. Hilton, T. E. Akers, P. Hoffman, John V. Houston and G. A. Carlson.

Reade Manufacturing Company, Jersey City, N. J.; model of chemical weed killing machine; C. H. Reade, R. H. Bogle and R. W. Pritchard.

Reliance Manufacturing Company, Massillon, Ohio; nut locks; H. J. McGinn, E. C. Gross, D. L. Robertson and H. R. Hanna.

Safety Guard Rail Lock Company, Orlando, Fla.; safety guard rail lock; H. L. Earle and W. L. Daughtry.

Selflock Nut & Bolt Company, East Syracuse, N. Y.; track bolts with lock nuts; M. E. Jennings.

Sellers Manufacturing Company, Chicago; wrought iron tie plates; G. N. Hogan, R. A. Van Houton and R. J. Platt.

Simmons-Boardman Publishing Company, New York; copies of *Railway Engineering and Maintenance*, Railway Age, Maintenance of Way Cyclopedia and Roadway and Track; L. B. Sherman, E. T. Howson, W. S. Lacher, F. C. Koch, B. J. Wilson, D. A. Steel, J. P. O'Hern and W. F. Rench.

Stevens Metal Products Company, Niles, Ohio; galvanized fence posts, steel barrels; Stanley H. Smith, George J. Purcell and E. D. Thompson.

Templeton, Kenly & Company, Ltd., Chicago; track jacks, car jacks, pole jacks and emergency jacks; J. L. Crowley and G. L. Mayer.

Union Switch & Signal Company, Swissvale, Pa.; insulated rail joints; J. J. Cozzens.

Van Dresar, E. L., St. Paul, Minn.; tie plates; E. L. Van Dresar.

Verona Tool Works, Pittsburgh, Pa.; track tools, nut locks, track jacks, rail joint springs; E. Woodings, J. S. Wincrantz and W. F. Hart.

Warren Tool & Forge Company, Warren, Ohio; adzes, clawbars, lining bars, picks, spike mawls, sledges, hammers, track chisels, wrenches; H. C. Mull, George F. Konold, M. J. Konold and J. D. Robertson.

Wm. Wharton, Jr., & Co., Inc., Easton, Pa.; insulated gage rod, photograph of manganese frog, gas cylinders; Victor Angerer, H. F. Heyl, H. F. McDermott and F. H. Lehecka.

Woolery Machine Company, Minneapolis, Minn.; motor car engines; section motor car; H. F. Woolery and C. E. Berg.

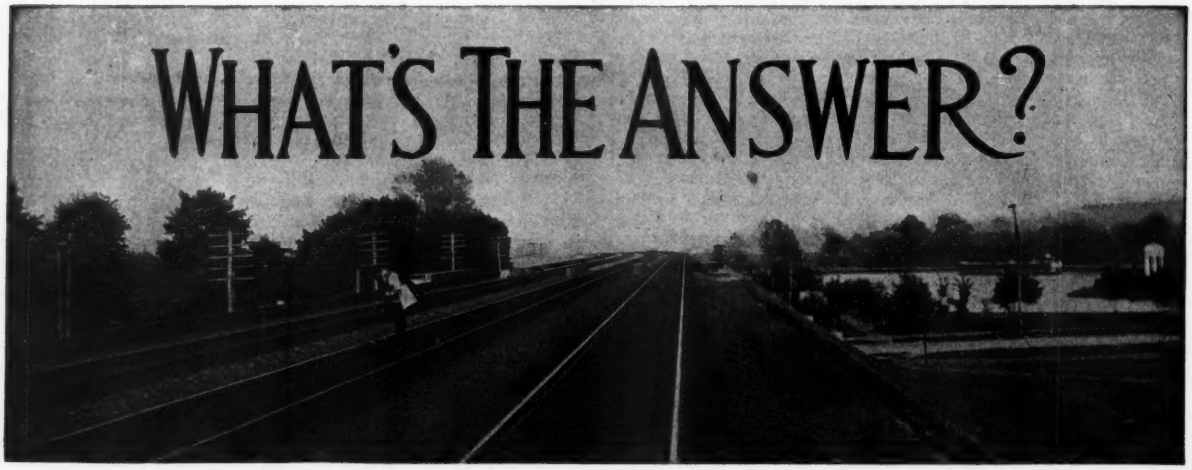
Wyoming Shovel Works, Wyoming, Pa.; track shovels, spades, scoops, scuffle hoes and picks; H. T. Potter, Stanley H. Smith, G. E. Geer and E. L. Ruby.

Non-Exhibiting Members

Cleveland Frog & Crossing Company, Cleveland, Ohio.
The Frog, Switch & Manufacturing Company, Carlisle, Pa.
Pettibone-Mulliken Company, Chicago.
St. Louis Frog & Switch Company, St. Louis, Mo.

At its annual meeting on Wednesday morning, the Track Supply Association elected the following officers for the ensuing year: President, J. J. Cozzens, Union Switch & Signal Company, New York City; first vice-president, A. H. Told, Positive Rail Anchor Company, Marion, Ind.; secretary-treasurer, W. C. Kidd, Ramapo-Ajax Corporation, Hillburn, N. Y. Directors: (One year) Alex Chapman, Rail Joint Company, Chicago, and K. J. Eklund, Mudge & Company, Chicago; (Two years) L. C. Ryan, Oxweld Railroad Service Company, New York City, and J. Howard Horn, National Lock Washer Company, Newark, N. J.

WHAT'S THE ANSWER?



This department is an open forum for the discussion of practical problems of engineering and maintenance of way. Readers are invited to send in any questions which arise in their work in the maintenance of tracks, bridges, buildings and water service. *Railway Engineering and Maintenance* also invites the co-operation of its readers in answering any of the questions listed below.

Questions to be answered in the December issue.

(1) What precautions should be taken when shimming track to overcome the effect of heaving?

(2) What is the minimum practical pitch for shingle roofs?

(3) Where foundation piles must be driven through filled ground is it objectionable to cut off the piling above the original ground surface and need creosoted timber necessarily be used under such conditions?

(4) What is the objection to the use of the same pipe line for the inlet and outlet of (1) tanks serving water columns, and (2) general service tanks?

(5) To what extent are section forces warranted in distributing throughout the winter the ties for the next year's renewals by means of motor cars?

(6) What kinds of painting can be done to advantage during the winter?

(7) What practical means may be adopted to overcome the seepage of water through foundation or retaining walls where the removal of the back fill is out of the question?

(8) Is the minimum head against which a pump is to work a factor to be considered in designing electric drive centrifugal installations?

Floors for Section Tool Houses

What type of foundation and floor construction is most satisfactory for section tool houses?

First Answer

For a frame tool house of the ordinary type, a foundation course of concrete, redwood, cypress or creosoted material may be used with satisfactory results. On the Southern Pacific we follow the practice of placing the floor level with the top of the rail of the adjacent track. The rails on which the motor cars are moved in and out of the house extend from the main track rail to the rear of the house, so that the top of these rails is at about the same level as the floor surface. We have obtained good results by subgrading the tool house floor with earth and covering it with a layer of 3 in. or 4 in. of crushed rock screenings, decomposed granite or similar surfacing material. This is much preferable to a plank floor and cheaper than a concrete floor. The area around the tool house is graded and covered with screenings and is made wide enough on one side of the house to provide room for a scrap bin. Underground gasoline storage with a pump inside of the tool house is provided. All oil cans are set in sandboxes on the tool house floor. Plank floors and runways are objectionable and should not be used.

H. M. LULL,

Chief Engineer, Southern Pacific, Atlantic System, Houston, Tex.

Sand Points vs. Bored Wells

Under what conditions, if any, is a dug well with sand points preferable to a drilled or bored well, where the ground water is near the surface?

First Answer

This question is not entirely consistent. Sand points are mentioned for the dug well, but as no screens or strainers are specified in connection with the drilled or bored wells, it is assumed that the common open bottom types are to be considered, at least in the case of the bored well. In practically any ground where an open bottom bored well can be finished, sand points should be unnecessary in the bottom of a dug well. If the sand is so fine that sand points are necessary in the dug well, it would be impossible to finish a good open bottom bored well in it. This is assuming that the area of the bored well is considerably less than that of the dug well.

There are times when considerable water, that will rise nearly to the ground surface, is found in a thin vein of very fine sand, in which it is difficult and expensive to finish a drilled well. If there happens to be an impervious layer of clay or other material between the surface and this vein of sand, it is sometimes advisable to dig a large well to the impervious layer and then drive sand points through it to the underlying sand. These points, when allowed to flow into the dug well, do not plug up as easily as when pumped direct and usually

little sand raises with the water. These are the only conditions where I feel that sand points should be used in connection with a dug well. They always either fill up gradually or become coated on the outside and must be renewed often on this account. They are very expensive to maintain on this account.

Engineer Water Service.

Second Answer

There was a time when a dug well was justified in localities where the ground water was near the surface. I do not believe, however, in this day when air jets and centrifugal pumps are in common use that there are any conditions where a dug well, either with or without sand points, is justified. My experience has been that dug wells become less efficient with age while the opposite is often true with properly developed bored wells equipped with open strainers. In developing a bored well, where the ground water level is near the surface, strainers of gravel can be utilized in case the formation does not contain sufficient coarse material to allow the strainer to be formed after the sand has been removed.

Dug wells equipped with sand points are seldom provided with any means whereby the strainers in these points are kept clean and free from the accumulation of sediment. This condition is absolutely necessary for the continued efficiency of the well. C. B. CLEGG,

Supervisor Water Service, Atchison, Topeka & Santa Fe, Amarillo, Tex.

Tight Joints for Soft Roadbed

Should joints be kept as tight where the roadbed is soft as where it is well supported?

First Answer

It is our practice to see that we have the proper expansion, and keep the bolts tight on all kinds of track.

T. TURNBULL,

Engineer Maintenance of Way, Canadian National, Winnipeg, Man.

Second Answer

The joints should be kept just as tight where the roadbed is soft as where it is well supported; otherwise the increased impact will make the joints still more difficult to maintain. W. S. HANLEY,

Chief Engineer, St. Louis Southwestern, Tyler, Tex.

Third Answer

Rail joints should be kept as tight as possible under all conditions. I have never observed any advantage from permitting them to be loose on soft roadbed. Joints will batter just as much on soft roadbed, and if anything worse, where the joints are loose and the expansion becomes more unequalized. The track also creeps worse on a soft roadbed where the rail is not sufficiently well anchored to prevent it. J. J. HESS,

General Roadmaster, Great Northern, Seattle, Wash.

Fourth Answer

My experience is that the joints should be kept as tight as possible at soft places, as I have found that if the joints are not tight the track will become rough much easier than where it is on a solid foundation. When trains go over loose joints on a soft subgrade the joint ties are given a churning motion by the leaving end of the rail sinking down a little under the wheels, while the receiving end of the next rail sticks up above it. When the wheels hit this high end the joint is given a swinging motion downwards, causing the digging in of the joint ties. The first result is low joints. Then broken angle bars, surface-bent rails, flat or crushed heads on the rail ends and even broken rails result if the joint is not raised. Loose joints on a soft roadbed or in soft spots are also expensive. This condition causes rails to wear out and angle bars to break sooner than otherwise.

THOR MONRAD,

Section Foreman, Northern Pacific, Ollie, Mont.

Boring for Drift Bolts

To what extent should holes be bored for drift bolts in timber bridges?

First Answer

Drift bolts should only be used where absolutely necessary, and when used the holes should be bored of such size that the drift would fit tight to avoid dampness and to a depth so that the bolt can be driven through about two inches of the timber.

The head of the bolt should not be mashed into the timber, as this will cause decay. B. F. GEHR,

Master Carpenter, Pennsylvania, Richmond, Ind.

Second Answer

Except in the case of a structure built on account of a washout or for other temporary construction there is only one place in a timber bridge where a drift bolt is used to good advantage and that is as a fastening between the cap and the piling. In this case a hole should always be bored for the full length of the drift bolt. If a hole is not bored there is danger of the timber being split as well as the possibility of the drift not being driven in the timber where it will be most effective.

To drive a drift bolt through the end of a stringer as a means of fastening the stringer to the cap, as was the general practice in former years, often causes the end of the stringer or the cap to split and opens up the fibre of the wood, thereby creating an ideal condition for decay at the particular part of the bridge where the greatest strains occur.

To avoid the possibility of careless workmen attempting to drive drift bolts, specifications should always call for bolts without either head or point.

EDWIN M. GRIME,

Supervisor Bridges and Buildings, Northern Pacific, Fargo, N. D.

Housing Water Treating Plants

Is any advantage to be gained by housing the settling tanks of water treating plants?

First Answer

In the north, overcoats must be worn in winter; in the south, they need not be. When a water treating plant is properly designed, the chemical reactions have been completed, and the precipitate or "flock" has been formed when the treated water enters the settling tank, so that the function of the settling tank is merely to deliver the precipitate or sludge at the bottom and clean water at the top. The water in the sludge in the bottom of the settling tank is nearly quiescent and must not be allowed to freeze, because, in the continuous type of plant, the sludge must be drained off at least once a day. It is not sufficient that only the bottom of the tank be kept warm, because the warmer water from the bottom will flow continuously toward the top and carry precipitate with it.

I once built a steel combined settling and storage tank (the storage at the top) in which, because the tank was 50 ft. high, I housed and heated the bottom 15 ft. only. In the summer time the plant works very well, but in winter steady currents of warm water rise from the heated bottom and carry so much sludge with them that

the top water is never clear, and boilers using it always foam. As soon as the summer sun makes the top of the tank warmer than the bottom, the water clears up and the boilers no longer foam.

In the northern country, perhaps above the latitude of Kansas City, I should say that it pays to house the whole treating plant.

C. H. KOYL,
Engineer Water Service, Chicago, Milwaukee & St. Paul, Chicago.

Small Size Passenger Stations

What is the minimum practical size for small passenger stations?

In answering this question I assume that the term "passenger station" as here used, signifies a station where there is sufficient business to warrant the employment of an agent equipped to sell tickets. For such stations, the road on which I am employed provides a structure 16 ft. by 39 ft. in plan, which provides space for a waiting room 15 ft. by 12 ft., and a freight and baggage room 15 ft. by 16 ft., with an agent's office between the two, 9 ft. by 18 ft. 6 in., the greater length of this room being provided by a bay window projection of 3 ft. 6 in.

A smaller building than this could be built but the saving would be by no means in proportion with the reduction in floor area, since the cost per square foot would increase as the floor area was decreased.

General Building Inspector.

The Relative Merits of Managanese and Open Hearth Frogs

What are the relative merits of manganese rigid frogs and open hearth spring rail frogs for high speed main tracks?

First Answer

As a general proposition and for the high speed conditions where it is desired to provide easy and comfortable riding, we feel that spring rail frogs made in accordance with the plans adopted by the American Railway Engineering Association, which are similar in design and type to the standards we use, are preferable, particularly where the traffic is mostly in one direction. At points where the traffic is divided or detoured, rail bound manganese frogs are the only solution, and they are best suited for this class of service.

Where we use spring rail frogs on high speed main tracks and where the greater portion of the service is on the straight or main line side, we are satisfied that better and longer service is being obtained than if rail bound manganese frogs were used. We also feel that smoother and more comfortable riding is obtained.

J. V. NEUBERT,
Engineer, Maintenance of Way, New York Central, New York.

Second Answer

The answer to this question depends almost entirely upon traffic conditions. For turnouts in high speed main tracks where the turnout is used at a comparatively slow speed, and also for turnouts where the traffic through the turnout is not over 25 per cent of the total, I recommend the use of spring frogs. I believe that under these conditions a spring frog will last as long as a manganese insert frog and be less expensive.

Where the traffic through the turnout is either fast or more than 25 per cent of the total, I prefer manganese insert frogs, as they will give longer life and be more economical than spring rail frogs under these conditions.

Where a spring rail frog carries a large amount of traffic through the siding, the opening and closing of the spring rail has an appreciable effect on the frog, which will be noticeable in time. Consequently we do not get as much life from a spring rail frog under these conditions.

W. P. WILTSEE,
Acting Chief Engineer, Norfolk & Western, Roanoke, Va.

Joints in Concrete Culverts

Should long reinforced concrete culverts be built continuous from end to end, or separated by transverse joints into independent sections?

First Answer

Long culverts are best constructed continuously from end to end without joints, care being exercised to provide sufficient longitudinal reinforcement in the upper slab to transfer the variation in load created by a varying fill, as well as in the invert to equalize the soil pressure and preclude the unequal settlement which might arise at the ends of sections due to the inevitable variation of the unit soil pressures. These culverts, being covered with fill, are not subject to expansion due to temperature changes to anywhere near the extent to which exposed structures are.

M. HIRSCHTHAL,
Concrete Engineer, Delaware, Lackawanna & Western, Hoboken, N. J.

Second Answer

The question is a general one and can only be answered in an arbitrary manner. So far as it is possible, it is our practice to build reinforced concrete boxes in complete sections above the floor slab, these sections being determined on the basis of a reasonable day's work. Considering the size of the work involved in the construction of these boxes, this will in most, if not in all cases, result in several transverse joints, although the reinforcement is carried across these joints. Consequently, the joint is not effective as such. For ordinary conditions, I do not think that transverse joints in long reinforced concrete culverts are necessary. Foundation conditions might change this, however, and the length might be a factor. The above is based upon consideration of culverts which would be ordinarily encountered in railroad work.

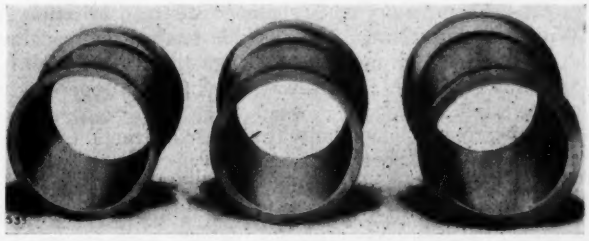
C. C. WESTFALL,
Engineer of Bridges, Illinois Central, Chicago.

Where Electricity Has Supplanted Steam

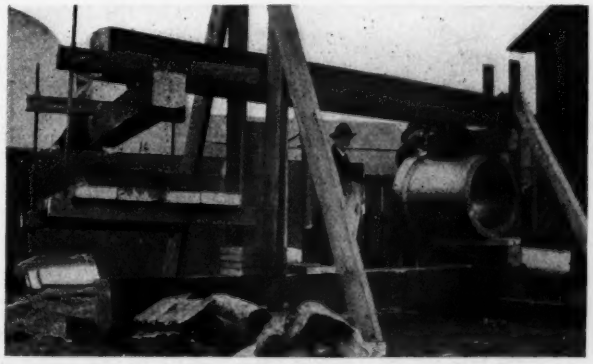
NEW DEVICES

Stronger Vitrified Pipe for Culverts

VITRIFIED culvert pipe having an average crushing strength 65 per cent greater than the commonly used sections is a recent development designed to meet the increase in the loads to which railroad and highway embankments are being subjected. This product is a development of the W. S. Dickey Clay Manufacturing Company, Kansas City, Mo., which classifies it as its triple strength pipe to distinguish it from other grades of pipe handled. A comparison of the new pipe with the earlier developed forms brings out the difference in strength. Taking 24-in. pipe, the standard vitrified pipe is 1⅝ in. thick and has an average crushing strength of 3,600 lb. per lin. ft.; the double strength pipe is 2 in. thick and has an average crushing strength of 4,500 lb. per lin. ft., while the triple strength pipe is 2½ in. thick and has an average crushing strength of 6,000 lb. per lin. ft.



Examples of the Triple Strength Pipe



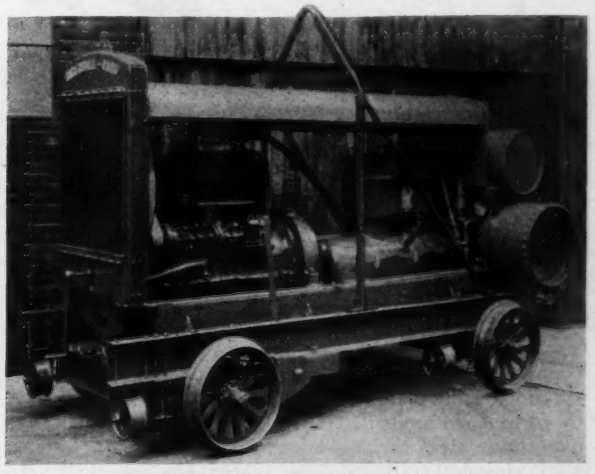
Testing the New Pipe for Crushing Strength.

After testing the new pipe, the Bureau of Public Roads, Federal District No. 8, of Alabama, altered its established policy of asking for bids only on the basis of cast iron pipe, to include the pipe in question for all installations under pavements on Federal Aid projects. The testing was done with an apparatus consisting of a timber beam under the fixed end of which was placed a 24-in. pipe and from the free end of which was hung a platform upon which pig iron was loaded. As a result of the test, in which the total pressure on at the breaking point was found to be 13,857 lb. or 6.9 tons, the strength of the pipe was rated at 2,771 lb. times the diameter in feet. Among other tests the Kansas State Agricultural College subjected a 24-in. section both to the three point method and the sand cushion method, the result of the three point method being to disclose an average strength of 6,440 lb. per lin. ft.

The pipe is a salt glazed product manufactured under the same conditions as the double strength pipe, which gives it the characteristic resistance to corrosion and disintegration. To this is added the increased strength under service, as mentioned, and the greatly increased resistance to fracture during shipment or handling.

Improvements in the 12-Tool Tamper

THE Ingersoll-Rand Company, New York City, has recently made a number of improvements in its 12-tool tie-tamper compressor unit which permit of an increased flexibility of operation and ease of maintenance and repair. The original unit was mounted upon skids and was handled by means of a bale by which it could be picked up by a locomotive crane and moved from place



The 12-Tool Tamper

to place. Later the unit was mounted on wheels so that it could be transported over the rails from place to place.

In the improved model, the unit is made self propelling, using a chain drive controlled by a clutch and lever. The power and compressor units have been redesigned with the result that they are now set lower in the frame and have a direct drive. The air and gas tanks have been removed to the outside of the unit, making both the motor and compressor easily accessible on both sides and the top for the removal of cylinder heads, valves and other miscellaneous maintenance and repair work.

The compressor unit has a capacity of 250 cu. ft. of free air per minute with a maximum pressure of 100 lb. per sq. in. It is driven by a four cylinder, four cycle, gasoline motor of 40 h. p. The cooling is effected by a large size sectional radiator, the component parts of which are easily replaceable. The entire unit with the exception of the tanks, is enclosed by a light steel housing with removable doors or side panels. It is also equipped with a bale as in the former models.

A 1¼-Yard Steam Shovel With Crawler Treads

THE Osgood Company, Marion, Ohio, has added to its line of steam shovels a 1¼-yd. steam operated shovel with crawler tread. This machine has twice the capacity of the crawler shovel heretofore manufactured by the company and has been designed for heavy duty. Like the smaller shovel, upon the experience with which it has largely been built, the new shovel is of the full revolving type, with horizontal hoisting engine, a submerged tube type boiler, a centering gudgeon for connecting the main casting and the path gear, power gearing on both the continuous tread and traction mounting, double geared shipper shaft and automatic trip rope tension.

To meet the demands for heavy service, all shaftings are made oversize and unusually large bearing surfaces have been provided at the points of greatest stress. The

The New Shovel Has a 1¼-Yd. Dipper

boom and dipper handle are built up of white oak timber shrouded with plate steel and the whole bolted together to form solid units. The dipper handle is fitted with manganese steel racking which operates over manganese steel pinions on the double geared shipper shaft, the objective in the design of the latter being to insure equal application of the power to the dipper handle rack in order to minimize side strain and twisting and to give a more positive thrust to the dipper.

The hoisting and swinging units are assembled above the deck on the upper body center member, a one piece open hearth steel casting. Experience has shown that this type of construction insures satisfactory rigidity of the upper body, which rotates on conical manganese steel rollers set in the upper body frame. These rollers are adjustable and can be removed without jacking up the body. The pads on which the path gear rests are machined and securely riveted to the truck frame, while the gears are also machined in order to minimize frictional resistance and unequal strain. The truck frame is a one piece open hearth steel casting, also machined, and while designed especially for the continuous tread mounting, is adapted also to the use of traction or railroad trucks, all of which are readily interchanged.

The continuous mounting is made simple to facilitate repairs and is an all-gear drive arrangement with the number of bearings and other wearing parts reduced to the minimum. The tread links are one-piece shaftings with high guiding flanges which move along rollers or wheels set in a rigid frame. These rollers hold the treads in place and prevent side slipping. Round tumblers with teeth on the sides engage the guiding flanges and transmit the power to the tread belt, an arrangement which eliminates pocket holes likely to become clogged with dirt and stone.

Steering is accomplished by a steam ram, controlled by a single lever in the operator's position. One tread belt is held stationary when the opposite tread belt moves. With this arrangement it is possible to turn the machine at right angles or merely to change the course slightly as desired without in any way moving the upper body of the machine.

Aside from its adaptability to the use of traction wheels or a railroad truck, the machine can be equipped with a high lift boom or a trenching dipper and is especially suited for use with a clam shell or drag line bucket, or as a crane. The drums furnished for clam shell equipment have sufficient power to operate the bucket with a single line, thus greatly speeding up the operation as well as reducing wear on the lines and eliminating a set of sheaths at the bucket connection.

Increased Life From Fencing

THE doubling of the life of galvanized wire for right-of-way fencing purposes is claimed for a new method of applying the zinc coating which has been developed by, and is being applied to, the product of the Keystone Steel & Wire Company, Peoria, Ill. The fencing commonly used for right-of-way purposes is built up of "four immersion" line wire and "three immersion" stays, frequently surmounted by a "two immersion" barbed wire. The number of immersions is a measure of the amount of galvanizing on the wire and thereby of the degree of protection against corrosion. It refers to the Preece copper sulphate test of galvanizing in which the specimen is dipped into a solution of copper sulphate of a given strength for one minute and the acid then rubbed off, this operation being repeated until the zinc is removed and a copper deposit forms on the wire. The number of such immersions which a specimen will withstand before showing this copper indicates the quality of the coating. As commonly applied, it has been practicable to give the stays only a "three immersion" coating, as a heavier coating will flake off in the fabrication of the fence.

The feature of the new process which overcomes this condition is the passage of the wire through a heat treating furnace immediately after leaving the spelter pan where it is coated with the zinc. As the wire passes through this furnace which is maintained at a high temperature, the zinc coating is maintained in a plastic con-

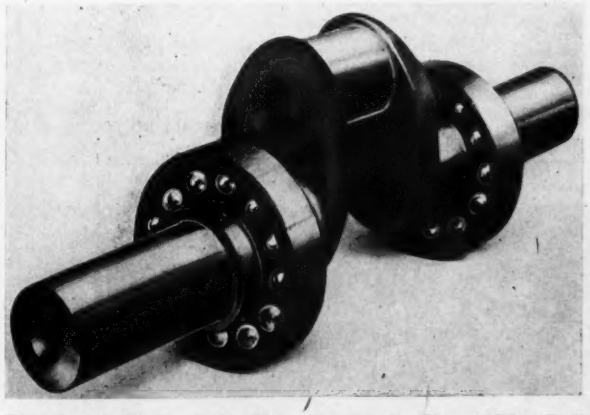
dition for a sufficient length of time to permit an even distribution of the zinc over the surface of the wire. It is also claimed that the zinc amalgamates with the wire to some extent and prevents its peeling off. By reason of this close bond, it is possible to apply a "four immersion" coating to the stays and also to the barbed wire, providing a fence of uniform resistance to corrosion and of a life equal to that of the line wires. It is by reason of this fact and also because it is possible to add even more than a "four immersion" coating that the life of this fence is claimed to be more than double that of ordinary railroad fence.

The development of this method of treatment has been in progress for more than two years, although the wire itself has now been produced commercially for about eight months. Samples of this product, which is sold under the trade name of galvannealed wire, which were submitted to Robert W. Hunt & Company for analysis in comparison with ordinary galvanized wire purchased in the open market showed more than twice the amount of zinc, while other samples submitted to the Burgess Laboratories, Madison, Wis., showed three samples withstanding six immersions and two five immersions. Other samples submitted to the salt spray test showed a life much greater than that of galvanized wire commonly used. This wire, to which the name Galvannealed has been given, is made in the standard forms of construction of woven and barbed wire and is being used in quantity on several roads.

The Woolery Engine Improved

ABOUT four years ago the Woolery Machine Company, Minneapolis, Minn., built a small number of engines with their crank shafts fitted with ball bearings and placed these engines under observation. The results proved so satisfactory that the company is now beginning the manufacture of what is known as the New Woolery engine, in which the distinguishing feature is the ball bearing construction. The position of the ball bearings in the crankshaft of the new engine is shown in one of the accompanying illustrations.

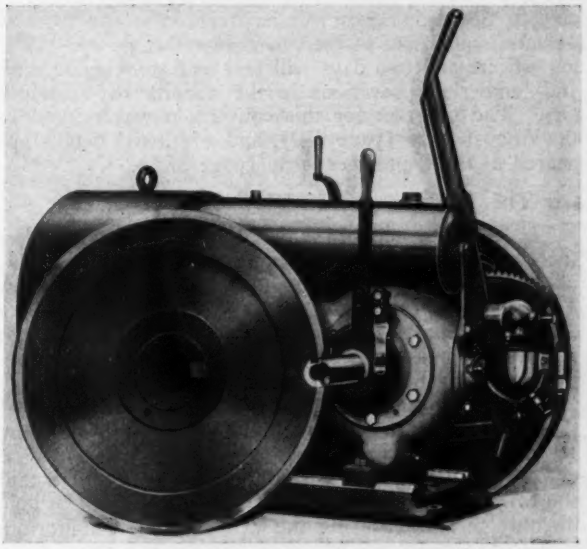
It is claimed that the unusually long stroke, gas-tight piston rings, and other features which characterize the



The Crank Shaft of the New Engine Is Fitted With Ball Bearings

Woolery engine result in an engine of unusual power at slow speeds. This characteristic, together with the durability of the engines, are said to be even more pronounced with the ball bearings crank shaft. One of the most important advantages in the form of crank shaft used is the sectional metallic packing employed for sealing the joint around the shaft. This packing not only is free from the hardening action common to the use of fabric packing, but also automatically takes up its own wear, its efficiency being such that it is guaranteed against the need of any attention whatever for four-years. Both the packing and the ball bearings are automatically lubricated by the oil mixed with the gasoline for consumption in the engine.

These engines, like the ones heretofore manufactured by this company, are built in four sizes, 5 and 7½ hp.



The New Woolery Engine With the Fly Wheel Removed to Show the New Timer

single cylinder, and 10 and a 15 hp. twin clyinder, all of which are rated for ten years' service. In keeping with the Woolery design, one lever only is used for all speeds as well as for reversing and stopping. The engines are also equipped with the special sliding base which operates both to keep the engine in proper alinement and to afford convenient adjustment of the belt drive. The new engine also carries the familiar Woolery water jacket, the construction and mounting of which are designed to give it a freeze-proof character as well as to prevent the upward escape of steam while the car is in operation.

A new feature of the engine, aside from the ball bearing crank shaft, is a timer which consists of a large two-piece fibre washer which is bolted to the flywheel in such a manner that it can readily be taken off with an ordinary screwdriver for repair or replacement without removing the flywheel. The timer brush is in the form of a spring carried by an aluminum fastening held to the bearing cover by a U-bolt, the arrangement of which is also such as to permit the whole timer to be removed from the engine without disturbing any other part. This construction is shown in one of the illustrations.

In designing the new car a new throttle valve has also been developed to prevent crank case explosions when the car is running idle. This throttle is of the rocking valve type and is made in one piece except that it has a screen through which the idling charges pass before reaching the explosion chamber. When the throttle valve is wide open, it is not necessary for any charge to pass through the screen, the valve thus presenting no obstruction to the free passage of the gas under this condition.

DEPRECIATION DISCUSSED—A public hearing will be held before the Interstate Commerce Commission beginning October 1, concerning the depreciation charges of railroads.

Association Activities

The Bridge and Building Association

More than 200 persons will leave Chicago on a special train on Saturday evening, October 6, for the thirty-third annual convention which will be held at Seattle, Wash., on October 16-18. The train will travel over the Chicago, Burlington & Quincy to Denver, the Denver & Rio Grande Western to Salt Lake, and the Union Pacific to Seattle. Stops will be made en route to visit numerous points of interest to railway bridge and building officers and two days will be spent studying logging and lumbering operations in the vicinity of Portland, Ore. The program for this convention was printed in the August issue (page 330), and additional details appeared in the September issue (page 372.)

The Maintenance of Way Club of Chicago

The Maintenance of Way Club of Chicago held a successful meeting on Monday evening, September 17, in the form of a dinner in honor of the Metropolitan Track Supervisors' Club of New York, and members of the Roadmasters' Association, who were in Chicago for the Roadmasters' convention, approximately 100 being in attendance. The speaker of the evening was C. M. Taylor, superintendent of timber preservation of the Philadelphia & Reading and the Central of New Jersey, who described the precautions which must be taken by the users of treated wood in order to obtain the full benefit of the treatment. It was decided to hold monthly meetings during the winter at the Auditorium Hotel.

The International Track Supervisors' Club

The annual meeting of the International Track Supervisors' Club was held at Niagara Falls, N. Y., on August 25, at which time the following officers were elected for the ensuing year: President, L. S. Weaver, track supervisor, Erie, Attica, N. Y.; vice-president, William Wharry, general roadmaster, Canadian Government Railways, St. Thomas, Ont.; secretary-treasurer, D. F. Hilton, Ramapo Ajax Corporation, Niagara Falls, N. Y.; members of the executive board, M. J. Cooney, track supervisor, Erie, Salamanca, N. Y.; John Fitzgerald, roadmaster, Buffalo, Rochester & Pittsburgh, Rochester, N. Y.; J. P. Sexton, supervisor of track, New York Central, Lackawanna, N. Y., and Charles Durham, roadmaster, Michigan Central, Welland, Ont.

It was decided to hold the meetings of the club quarterly instead of bi-monthly and on Thursday instead of Saturday.

The Material Market

THE last few weeks have been characterized by a general slowing up of material purchases, which has been reflected in turn by a decrease in production, particularly in blast furnace operations. While this has been responsible for some weakness in prices, this has not been carried far enough to become apparent in many of the published quotations, for, as noted in the iron and steel prices listed below, only those relating to structural steel are actually lower than a month ago.

PRICES IN CENTS PER POUND

	August 20		September 20	
	Pittsburgh	Chicago	Pittsburgh	Chicago
Track spikes	3.15	3.25	3.15	3.25
Track bolts	4.00 to 4.25	4.25	4.00 to 4.25	4.25
Angle bars	2.75	2.75	2.75	2.75
Tie plates, steel	2.55 to 2.60	2.60	2.55 to 2.60	2.60
Tie plates, iron		2.85		2.85
Plain wire	2.75	3.09	2.75	3.09
Wire nails	3.00	3.34	3.00	3.34
Barbed wire, galv.	3.80	4.14	3.80	4.14
C. I. pipe, 6 in. to 12 in., per ton		$60.20		$60.20
Plates	2.50	2.60 to 2.80	2.50	2.60
Shapes	2.50	2.60 to 2.70	2.50	2.60
Bars, soft steel	2.40	2.50 to 2.60	2.40	2.50

Open hearth rails per gross ton f.o.b. mill, $43.

The scrap market is in a healthy condition, the prices being generally higher than those for the previous month, particularly in items with which the maintenance of way department is concerned.

PRICES PER GROSS TON AT CHICAGO

	August	September
Relaying rails	$32.00 to $35.00	$32.00 to $35.00
Rails for rerolling	17.50 to 18.00	17.50 to 18.00
Rails less than 3 ft. long	19.00 to 19.50	20.50 to 21.00
Frogs and switches cut apart	16.00 to 16.50	16.75 to 17.25
Steel angle bars	17.25 to 17.75	18.50 to 19.00

Conditions in the lumber market seem more favorable from the standpoint of the producers than they have been for several weeks. The Southern Pine Association reports moderate increases in orders on hand each week for the past month. However, there have been some further recessions in price, particularly in the case of some items of Southern Pine.

SOUTHERN PINE MILL PRICES

	August	September
Flooring, 1x4, B and B flat	$46.05	$44.55
Boards, 1x8, No. 1	39.00	34.95
Dimension, 2x4, 16, No. 1 common	26.20	26.05
Dimension, 2x10, 16, No. 1	28.70	25.95
Timbers, 4x4 to 8x8, No. 1	29.30	29.55
Timbers, 3x12 to 12x12, rough	36.80	40.70

DOUGLAS FIR MILL PRICES

Flooring, 1x4, No. 2, clear flat	34.00	34.00
Boards, 1x6, 6x20, No. 1, common	16.50	18.50
Dimension, 2x4, 16, No. 1, common	18.50	18.50
Dimension, 2x10, 16, No. 1 common	19.50	18.50
Timbers, 6x6 to 8x8, No. 1 common	24.00	27.00
Timbers, 10x10 to 12x12, rough	26.00	25.00

Reports from the cement mills indicate no recent fluctuations in the price of Portland cement.

The Members and Guests of the International Track Supervisors Club at Niagara Falls, N. Y., on August 25

General News

Accidents at highway crossings on the Pennsylvania railroad more than doubled during July, as compared with the corresponding month of 1922, 46 persons having been killed and 39 injured, as compared with 21 fatalities and 35 injuries in the same month of 1922.

An increase of 24,165 in the number of stockholders in Class I railroads for the year 1922, as compared with 1921, is shown in the preliminary abstract of statistics issued by the Interstate Commerce Commission. The total number of stockholders December 31, 1922, was 777,132.

The National Safety Council will hold its twelfth annual meeting at the Hotel Statler, Buffalo, N. Y., on October 1, 2, 3, 4 and 5. The steam railroad section, of which L. D. Bentley, of the Chesapeake & Ohio, is chairman, will hold sessions on the second, third and fourth days, when topics of general interest to railway officers will be discussed.

Virtually all of the railroads of the Island of Honjo, the principal island of Japan, were heavily damaged by earthquakes on Saturday and Sunday, September 1 and 2. The line running from Tokio to Kobe probably suffered worst, according to press reports. The track was distorted beyond repair and a number of trains were hured from the rails. Five hundred passengers are reported to have been killed in one train wreck.

The administrator of the estate of a man who was killed in a grade crossing accident at Danville, Ill., in 1916 has paid the Chicago & Eastern Illinois $5,000 in settlement of its claim for damages to one of its locomotives and to its tracks, resulting from the accident. In the collision, the driver of the motor car and the engineman of the locomotive were killed, and the engine was derailed, causing considerable damage to the track.

On September 7, an official inspection car was derailed near Plain Dealing, La., on the St. Louis Southwestern, resulting in the death of W. O. Sublett, roadmaster at Lewisville, Ark., and D. W. Bowker, division superintendent at Pine Bluff, Ark., and serious injury to W. S. Hanley, chief engineer of the road, and W. E. McGraw, vice-president and general superintendent of the Texas lines. The car was a Pierce-Arrow automobile mounted on flanged wheels. The cause of the derailment is unknown.

Scholarships amounting to a yearly sum of $600 for four years, were recently awarded to two sons of Pennsylvania employees, who qualified in competitive examinations in which 17 participated. The scholarships are two of eight created in 1907 by the children of Frank Thompson, formerly president of the Pennsylvania, in memory of their father, to give sons of living or deceased employees, an opportunity to secure a technical education. The scholarship entitles the successful candidates to select the school which they desire to attend subject to the approval of the railroad.

The Union Pacific has recently undertaken the development of a 750-acre industrial tract at Los Angeles, Cal., which, together with the 250-acre terminal and shop development program, started last January, constitutes one of the largest projects of its kind in the United States. In the preliminary work one of the largest sewers ever constructed in Los Angeles has been completed to serve the district. The combined terminal and industrial project, which extends over a total of 1,000 acres, will, when in full operation, give employment to 50,000 workers and involve the expenditure of $50,000,000 in buildings and equipment.

The fastest train in Great Britain, and what is believed to be the fastest in the world, was recently placed in service on the Great Western, between Cheltenham and Paddington (London), where it is scheduled to cover the distance of 77¼ miles, from Windon to Paddington, in 75 minutes, or at the rate of 61.8 miles per hour. On the day of the first run the train gained on its schedule, so that the run was made at an average speed slightly in excess of 64¼ miles per hour. At one time a speed of 83 miles per hour was reached. The locomotive is painted green in color and the cars chocolate and cream, according to Great Western standards, while the total train weighs 250 long tons.

A thorough analysis of the transportation situation in the United States is being made by the Research Council of the National Transportation Institute, with headquarters at Chicago, with a view to publishing its findings and acquainting every voter with the broader aspects of the railroad problem. The chairman of the Research Council is Edgar Clark, formerly chairman of the Interstate Commerce Commission, the vice-chairman is Sidney Anderson, congressman from Minnesota, and president of the Wheat Council of the United States; while the directors include, E. T. Meredith, secretary of agriculture in Ex-President Wilson's cabinet, and John F. Stevens, formerly engineer in charge of the construction of the Panama Canal.

The Class 1 railroads had a net railway operating income of $84,591,400 for July, which is equivalent to an annual rate of return of 4.93 per cent on their tentative valuation as fixed by the Interstate Commerce Commission. In July of last year the same carriers earned a net operating income of $69,321,000, which was at the annual rate of return of 4.12 per cent, while in June of this year the rate was 5.47 per cent. Twenty-nine roads operated at a loss in July, of which eight were in the Eastern, five in the Southern and 16 in the Western district. Operating revenues in July totaled $535,577,300, an increase of $91,870,000, or 20.7 per cent, as compared with the same month last year, while operating expenses amounted to $414,333,300, an increase of $73,377,100, or 21.5 per cent.

All Previous records for the weekly loading of revenue freight were broken during the week ending September 1, when 1,092,567 cars were loaded. This is 23,000 more cars than were loaded during the previous week, which marked the previous high record this year, and is over 73,000 cars in excess of the record established in the fall of 1920. As compared with the corresponding week of last year, there was an increase of 168,761 cars, and as compared with the corresponding week of 1921, the increase was 261,279 cars. In spite of the fact that freight loading is the heaviest in history, the railroads had 66,559 surplus freight cars in good repair and immediately available for service on Aug. 29, while at the same time, the reported shortage of freight cars was only 9,441 cars. Last April the railways set out to reduce the unserviceable locomotives to 15 per cent by October 1. On September 1, the number of locomotives held for repairs requiring over 24 hours was 9,392 or only 14.7 per cent of the number on line. The number reported serviceable is the largest ever reported since the beginning of the compilation of locomotive equipment condition data by the Car Service Division of the American Railway Association. The objective as to freight car repairs had not yet been reached on September 1, but the number of cars in need of repairs was less than on any date since November, 1920, the total being 175,375 or 7.7 per cent.

Personal Mention

General

C. B. Pettigrew, division engineer of the Northern division of the St. Louis Southwestern, with headquarters at Pine Bluff, Ark., has been promoted to division superintendent, with the same headquarters, succeeding **D. W. Bowker,** deceased.

William J. Whalen, roadmaster of the Chicago, Milwaukee & St. Paul, has been promoted to trainmaster and roadmaster of the Chicago, Milwaukee & Gary line of this road, with headquarters at Joliet, Ill. Mr. Whalen was born at Lansing, Ia., on March 22, 1893, and entered railway service, after completing a high school course in 1909, as an extra gang timekeeper on the Chicago, Milwaukee & St. Paul. In 1911 he was promoted to timekeeper and assistant extra gang foreman, and in 1915 became an extra gang foreman, a position he held until August 8, 1916, when he was promoted to roadmaster. His promotion to trainmaster and roadmaster became effective September 15.

Ralph Peters, Jr., assistant superintendent of the Long Island, and previously an engineering officer, has been promoted to superintendent, succeeding W. E. Canning, deceased. Mr. Peters was born on May 5, 1887, in Cincinnati, Ohio, and graduated in civil engineering from Princeton University in 1908. Shortly after his graduation, Mr. Peters entered the service of the Long Island as a draftsman in the engineering department. In 1910 he became a clerk in the trainmaster's office and a few months thereafter became an assistant engineer in the construction department. Four years later he was promoted to office engineer of the construction and maintenance of way departments and held that position until 1916, when he was assigned to the transportation department as special engineer. In 1917 he was promoted to assistant trainmaster with special duties involving the operation at the various freight terminals in the road's western territory and a few months later was promoted to assistant superintendent in charge of the Bay Ridge division. Shortly thereafter his duties were extended to include passenger operation in the electrified zone. He spent a year with the American Expeditionary Forces as a lieutenant in the transportation corps and in 1919 returned to his former position with the Long Island. At the end of federal control he was promoted to superintendent of passenger transportation and upon a change in organization in 1922 he was appointed assistant superintendent in charge of both passenger and freight train operation.

Engineering

W. H. Swift, Jr., has been appointed radio engineer of the Canadian National with headquarters at Montreal, Quebec.

F. T. Miller has been appointed chief engineer of the proposed Appalachian & Western North Carolina, which is being sponsored by the state of North Carolina. His headquarters will be at Greensboro, N. C.

A. W. Johnson has been promoted to supervisor of water service of the Eastern lines of the Atchison, Topeka & Santa Fe, with headquarters at Topeka, Kan., succeeding William Archer, who has retired.

J. M. Campbell, division engineer of the Canadian Pacific, with headquarters at Winnipeg, Can., has been transferred to Moose Jaw, succeeding **C. S. Moss,** transferred to Nelson, B. C., in place of **T. Martin,** transferred to Winnipeg.

Major J. L. Charles, resident engineer on the Canadian National, with headquarters at Fort William, Ont., has been promoted to terminal engineer, with the same headquarters, succeeding **S. B. Wass,** promoted to engineer in charge of construction of the Toronto Eastern Railway, with headquarters at Oshawa, Ont. **J. B. Heron,** heretofore on location and construction work between Ottawa and Capreol, Ont., has been promoted to resident engineer on the Toronto Eastern Railway, with headquarters at Oshawa, Ont.

A. O. Ridgway, assistant chief engineer of the Denver & Rio Grande Western, with headquarters at Denver, Colo., has been promoted to chief engineer to succeed J. G. Gwyn, who has retired, and the office of assistant chief engineer has been abolished. Mr. Ridgway was born on February 23, 1870, at Lawrence, Kan., and graduated from the University of Kansas in 1892. He entered railway service in June, 1887, as a track laborer on the Denver & Rio Grande and between 1890 and 1892 was intermittently employed on that road as axman, chainman, rodman, instrumentman and draftsman. In 1893 he was appointed assistant chief engineer of the Bellefontaine Bridge & Iron Company and in the following year was promoted to chief engineer. Returning to the Denver & Rio Grande in 1895 he was employed as an assistant engineer and as a locating engineer until 1904, when he was appointed general superintendent of the Silverton Northern. In 1905 he again returned to the Denver & Rio Grande as office engineer and was later promoted to engineer of bridges and buildings. He was promoted to assistant chief engineer in 1909, which position he held at the time of his recent promotion to chief engineer, with headquarters at Denver.

A. O. Ridgway

Wm. A. Archer, supervisor of water service on the Atchison, Topeka & Santa Fe, has retired after 53 years in railway service and 23 years as supervisor of water service. He was born in Yorkshire, England, on April 7, 1848, and was educated at Chiswick, England. After being employed in the British Mercantile Marine from 1863 to 1870, he entered railway service as a chainman on the South & Lincoln, where he subsequently served consecutively as leveler, transitman, and foreman on construction work until 1873, when he came to the United States. After spending the next five years in the eastern states as a draftsman and surveyor, he entered the service of the Atchison, Topeka & Santa Fe as an employee in the Auditor's office in December, 1879. He was transferred to the engineering department as a draftsman on May 1, 1881, and continued in this capacity until February 1, 1887, when he was promoted to supervisor of buildings. On March 1, 1900, he became supervisor of water service, from which position he now retires at the age of 75 years. Mr. Archer has been active in the development of water treatment on the Santa Fe and designed the first treating plants established on that road.

Wm. A. Archer

T. L. Doyle, assistant division engineer on the Logansport division of the Pennsylvania, with headquarters at Logansport, Ind., has been promoted to division engineer of the Grand Rapids division, with headquarters at Fort Wayne, Ind., to succeed **W. R. Hillary,** resigned. Mr. Doyle began railway service while attending the University of

Pennsylvania, when he was employed as temporary transitman on the Pennsylvania during the summer seasons. He entered the service permanently on July 1, 1903.

J. A. Reed, acting division engineer of the Southwestern division of the St. Louis-San Francisco, with headquarters at Sapulpa, Okla., has been appointed division engineer, with the same headquarters, succeeding **J. G. Taylor,** who has been assigned to other duties.

Track

A. Swanson, has been promoted to roadmaster on the Canadian Pacific, with headquarters at Lipton Sask., succeeding **O. Hibbert,** transferred.

J. Newman, heretofore in charge of the yard of the Canadian National, at Stratford, Ont., has been promoted to roadmaster, with the same headquarters, succeeding **C. J. Carey,** deceased.

Charles B. Teller, roadmaster of the Southern division of the Chicago, Rock Island & Pacific, with headquarters at Fort Worth, Tex., has been transferred to the Kansas City Terminal division, with headquarters at Kansas City, Mo.

J. H. Johns has been promoted to roadmaster on the Northern division of the Chicago, Milwaukee & St. Paul, with headquarters at Horicon, Wis., to succeed **A. F. Carlson,** transferred to the Northern division, with the same headquarters, to succeed **W. H. Armstrong,** appointed roadmaster, at Beloit, Wis., to succeed **L. Hausel,** resigned.

A. F. Roper, track foreman on the St. Louis division of the Pennsylvania, Southwestern region, has been promoted to supervisor on the Zanesville division. **Thomas Binkley** has been promoted to assistant supervisor on the Cincinnati division, and **Paul Reeves,** yard foreman on the St. Louis division, has been promoted to supervisor on the Cincinnati division, the latter to succeed **Michael Guilday,** retired.

J. L. Lewis, rodman on the Eastern Pennsylvania division of the Pennsylvania, has been promoted to assistant supervisor at Hollidaysburg, Pa., to succeed **Albert Cross,** who has been transferred to Mifflin, Pa., in place of **G. H. Slaughterer,** who has been promoted to assistant supervisor at New Brunswick, where he succeeds **C. W. Van Nort.** Also **E. L. Hunter,** rodman on the New Jersey division, has been made assistant supervisor on the Delaware division, and **R. F. Dunkle,** transitman in the office of the chief engineer, maintenance of way at Philadelphia, has been promoted to branch assistant supervisor, with the same headquarters.

N. Strunk, construction foreman of the Cincinnati, New Orleans & Texas Pacific (a subsidiary of the Southern), has been promoted to track supervisor, with headquarters at Williamstown, Ky., to succeed **R. M. Daffron;** and **H. McClendon,** a track foreman on the Atlanta division of the Southern, has been promoted to track supervisor of the Fort Valley Line, with headquarters at Williamson, Ga., to succeed **J. D. Buffington,** resigned.

Mr. McClendon was born on August 25, 1881, at Attala, Ala., and entered railway service on September 8, 1908, as a laborer on the Southern. He was promoted to foreman on April 28, 1909, and held this position continuously until his recent promotion to track supervisor.

Bridge and Building

E. B. Brink, superintendent of bridges and buildings of the Lake Erie & Western, with headquarters at Tipton, Ind., has resigned to engage in private business at Williamsport, Pa.

W. Walkden, assistant bridge engineer of the Canadian National, with headquarters at Winnipeg, has been promoted to bridge engineer, with the same headquarters, succeeding **J. G. Le Grand,** deceased.

L. H. Harris has been promoted to assistant supervisor of bridges and buildings on the Central division of the Union Pacific, with headquarters at Marysville, Kans. **L. F. McMaster,** has been promoted to a similar position on the Nebraska division, with headquarters at Omaha, Nebr.

R. H. Legg, supervisor of stations and transfers on the Southern division of the Pennsylvania, has been appointed supervising agent of the Maryland division, to succeed **E. H. Roe,** promoted, and **W. R. Taggart,** inspector of buildings on the Philadelphia Terminal division, has been appointed assistant master carpenter on the New York division.

P. P. Lawrence, assistant superintendent of bridges and buildings of the Lake Erie & Western, with headquarters at Tipton, Ind., has been promoted to superintendent of bridges and buildings, succeeding **E. E. Brink,** resigned. **H. F. Turnbell** has been promoted to assistant superintendent of buildings and bridges, with headquarters at Tipton, Ind., succeeding **Mr. Lawrence.**

John Rothman, master carpenter on the Cumberland Valley division of the Pennsylvania, was retired on August 8 after 45 years of service with that road. Mr. Rothman was born at Chambersburg, Pa., on August 8, 1852, and entered railway service as a trackman on the Pennsylvania on May 1, 1871. On April 30 of the following year he left railway service to become a carpenter apprentice with a contracting firm, but re-entered the employ of the Pennsylvania in May, 1879, following which he was employed as a carpenter until 1881, when he was promoted to carpenter foreman. He was promoted to master carpenter in 1895, and held this position continuously until July 1, 1923, when he was relieved after a period of 45 years and four months of service.

J. L. Gass, bridge and building foreman on the Alabama Great Southern-Belt Railway of Chattanooga (a subsidiary of the Southern has been promoted to supervisor of bridges and buildings on the Southern, with headquarters at Selma, Ala., to succeed **R. J. Jones,** who has been appointed supervisor of the Alabama Great Southern at Birmingham, Ala., in place of **J. R. Murray,** who has been appointed bridge inspector. **I. J. Newsome,** bridge and building foreman of the Birmingham Terminals of the Southern, has been promoted to supervisor of bridges and buildings at Birmingham, to succeed **R. R. Norrell. J. B. Teaford** and **Edward Veith,** supervisors of bridges and buildings on the Western district of the Southern, with headquarters respectively at Louisville, Ky., and Huntingburg, Ind., have had their territories extended to absorb the territory under the jurisdiction of **L. D. Beatty,** prior to his appointment as assistant roadmaster.

Purchases and Stores

Eugene S. Marsh has been appointed general storekeeper of the Wheeling & Lake Erie, with headquarters at Brewster, Ohio, succeeding William Hunt, resigned.

C. C. Dibble, supervisor of stores of the New York Central with headquarters at Indianapolis, Ind., has been appointed general supervisor of stores with the same headquarters.

G. A. J. Carr, division storekeeper of the Chicago, Milwaukee & St. Paul, with headquarters at Minneapolis, Minn., has been promoted to assistant district storekeeper, with the same headquarters, and will be succeeded by **H. E. Rice,** division storekeeper, with headquarters at Austin, Minn., who in turn will be succeeded by **W. M. Glenny.**

Obituary

W. O. Sublett, Lewisville, Ark., roadmaster on the St. Louis Southwestern was killed on September 7, as a result of the derailment of an official inspection car on which he was riding with others, near Plain Dealing, La.

John R. Phelan, formerly general superintendent of the Wyoming district of the Chicago, Burlington & Quincy, and an engineering officer, died at Denver, Colo., on August 28. Mr. Phelan was born on July 11, 1851, at New London, Conn., and entered railway service in 1869 in the engineering department of the West Wisconsin, which is now a part of the Chicago, St. Paul, Minneapolis & Omaha. He served on various western roads until 1882, when he was appointed roadmaster on the Burlington & Missouri River, being later promoted consecutively to trainmaster, assistant superintendent and superintendent of the Wyoming division. He was transferred to the Alliance division of the Chicago, Burlington & Quincy in November, 1902, and on May 1, 1905, was promoted to general superintendent of the Wyoming district, from which he retired in 1906.

Construction News

The Alabama & Vicksburg has awarded a contract to the Truscon Steel Company, Youngstown, Ohio, for the erection of a steel repair shop, 208 ft. by 64 ft. at Vicksburg, Miss., to cost approximately $57,000.

The Atchison, Topeka & Santa Fe contemplates the construction of a branch line to Longbeach, Cal., either by the extension of its line now under construction at Wilmington or by the route skirting the eastern city limits of Los Angeles through Hobart.

This company will construct a brick, tile and reinforced concrete passenger station at Cushing, Okla., at a cost of approximately $128,000.

This company, through the El Dorado & Santa Fe Construction Company, which is building a new line from El Dorado, Kan., to Ellinor, has purchased a 200-acre tract near Cassoway, Kan., as the site for a 800,000,000 gal. storage reservoir. Plans include the construction of a concrete dam on the Walnut river, to be 2,200 ft. long, with a 250-ft. spillway.

This company has awarded a contract to the Watson Construction Company, Dallas, Tex., for the construction of a 19-story steel and concrete office building, a 10-story brick and steel warehouse and two 8-story brick and steel warehouses at Dallas, Tex. The office building will be 200 ft. by 135 ft. and will contain display rooms and offices for supply companies as well as general offices for the road. The 10-story warehouse will have 335,290 sq. ft. of floor space and will be occupied by transfer and dry storage companies. One 8-story warehouse will be 245 ft. by 100 ft. and will be used for the handling of merchandise. The third warehouse will be 171 ft. by 150 ft. and will be devoted to cold storage commodities. The total cost of the project is estimated at $5,000,000.

The Baltimore & Ohio has awarded a contract to William Dwyer, of Cincinnati, for additions to its tie treating plant at Green Spring, W. Va.

The Central of Georgia plans the construction of a new freight and passenger station at Louisville, Ala., to cost approximately $10,000.

The Chesapeake & Ohio will construct a new engine house and additional tracks in its yard at Russell, Ky.

The Chicago & Eastern Illinois contemplates the construction of a new freight yard at Terre Haute, Ind., in connection with the new locomotive and car shops which were reported in the July issue.

The Chicago Great Western is receiving bids for converting a water station to a water treating plant at Oelwein, Iowa.

The Chicago, Milwaukee & St. Paul has awarded a contract to R. C. Wieboldt & Co., Chicago, for the construction of a six-story concrete addition to its building at 2435 Southport avenue, Chicago.

The Cleveland Union Station has awarded a contract to the Walsh Construction Company, Davenport, Iowa, for the excavation of the new site for the Union station at Cleveland, Ohio, the excavation work to cost approximately $250,000.

The Colorado, Columbus & Mexican's petition to the Interstate Commerce Commission, a certificate of public convenience and necessity for the construction of some 600 miles of line in New Mexico, Texas and Arizona has been disapproved by the examiners.

The Denver & Rio Grande Western was granted permission by the United States District Court on August 24, to lay 49 miles of narrow gage track from Durango, Colo., to Farmington, N. M.

The Grand Trunk is receiving bids on a two-story, 90-ft. by 30-ft. brick extension to its freight house at Flint, Mich.

The Great Northern contemplates the construction of a new one-story machine and repair shop at Minot, S. D., to cost approximately $85,000.

The Illinois Central reported in the May issue as authorizing the construction of a two-story brick passenger station at Champaign, Ill., 45-ft. by 228-ft., has awarded this contract to Ellington-Miller, Chicago. This company, in conjunction with the Pennsylvania, will construct a two-story brick passenger station with one-story express and baggage stations at Effingham, Ill., at an approximate cost of $100,000.

This company has authorized the construction of a flood wall at Vicksburg, Miss., to cost approximately $125,000, and improvements to the Stuyvesant docks at New Orleans, La., to cost approximately $380,000, and will construct a subway at Cotton Hill, Springfield, Ill., at a cost of $28,000. Bids for which will be requested in the near future.

This company will construct a new passenger depot at Hazlehurst, Miss., at a cost of approximately $45,000.

This company has awarded a contract to the Railroad Water & Coal Handling Company, Chicago, for the construction of a 300-ton coal chute at Dubuque, Iowa.

The Illinois Terminal Company will construct additional storage and switch tracks at Alton, Ill., on seven acres of land along the Mississippi river which it has recently purchased.

The Louisiana Railway & Navigation Company has been ordered by the Louisiana Public Service Commission to construct a new freight and passenger station at Mansura, La. The plans for the building are to be completed within 90 days.

The Louisiana & Aransas has awarded a contract to O'Neill & Sons, Hope, La., for the construction of an office building at Minden, La.

The Missouri Pacific contemplates the removal of its engine terminal from Hoxie, Ark., to Poplar Bluff, Mo., where it is planned to enlarge the roundhouse and shop facilities and closed bids August 27 for the remodeling of a 25-stall roundhouse at Kansas City, Mo.

This company has awarded a contract to Joseph E. Nelson & Sons, Chicago, for the construction of a new passenger station at Crane, Mo.

This company plans the construction of a branch from Charleston, Ark., to coal fields in that vicinity, a distance of approximately four miles.

The Moffat Tunnel Commission has awarded a contract to Hitchcock & Tinkler of San Francisco, Cal., and New York, for the boring of a main tunnel, 16 ft. by 24 ft., and a pioneer tunnel, 8 ft. by 8 ft., each six miles long, through the Continental Divide, west of Denver, Colo. The cost of the construction is estimated at $5,250,000.

The Nashville, Chattanooga & St. Louis which was reported in the September issue as closing bids on August 6 for the construction of an eight-story office building at Nashville Tenn., has awarded a contract for this work to the Southern Ferro Concrete Company, Atlanta, Ga. The building will be 50-ft. by 90-ft. and of reinforced concrete, faced with brick and terra cotta.

The National Railways of Mexico have awarded a contract to J. H. Maxey, Yuma, Ariz., for the construction of the last 90 miles of its new line from Mexicali to the Gulf of California, which was reported in the July issue. The awarding of the contract for the grading of the 34 miles to the Pioneer Transfer Company, Calexico, Cal., was reported in the September issue.

The New York, Chicago & St. Louis closed bids on August 27 for the construction of a new roundhouse at West Frankfort, Ind., where it also plans the construction of a new repair shop and other terminal facilities.

This company has purchased 200 acres of land at Fort Wayne, Ind., as a site for a new freight terminal and yard, and plans the construction of a one-story addition, 99 ft. by 157 ft., to its shops at Ninety-third street and Stony Island avenue, Chicago.

The Ochoco Timber Company contemplates the construction of a line from Prineville, Ore., to a recently purchased tract of 73,000 acres of pine timber 15 miles east of Prineville.

The Oregon Short Line will erect a new 650-ton coaling station at Glens Ferry, Idaho.

The Philadelphia & Reading has awarded a contract to the McLean Contracting Company, of Philadelphia, for constructing reinforced concrete foundations for a coal thawing house to be located at Pier 18, Port Richmond, Philadelphia. This house will be used in connection with the new car dumper plant under construction at that plant.

The Prescott & North Western has applied to the Interstate Commerce Commission for authority to construct an extension from Prescott, Ariz., for a distance of 26 miles in Nevada County.

The St. Louis-San Francisco plans the construction of a reinforced concrete and brick freight station and office building at Birmingham, Ala.

The Rio Grande City & Northern has been chartered in Texas to build a line 85 miles long from Sam Fordyce, in Hidalgo county, to Rio Grande City, in Starr county, and thence to a connection with the Texas Mexican railway in Webb county. The proposed line will follow a northwesterly direction to make the connection with the Texas Mexican line, and a later extension to Mirando, making a total of 85 miles. V. H. Williams, Dallas, Tex., is vice-president of the company.

The Southern Pacific has applied for authority to acquire from Frank G. Drum control of the Chowchilla Pacific, extending 11.68 miles from a point on the Southern Pacific in Madera county, Cal., to Dairyland, Cal.

This company will construct additional yard tracks at the Beale street yards, San Francisco, Cal., at a cost of approximately $122,000, and contemplates changes in its line entering Portland, Ore., and improvements to its terminals at that place to cost approximately $4,500,000. This company has awarded a contract to John Hampshire, Grants Pass, Ore., for the construction of the first section of 31 miles of the new line from Eugene, Ore., to Klamath Falls, known as the Natron cut-off.

This company has completed plans for the construction of a one-story machine shop, 85-ft. by 498-ft., in Los Angeles, Cal., to cost approximately $390,000, with equipment. This company's plans for the development of its shop facilities at Los Angeles at a total cost of approximately $1,000,000 were reported in the March issue.

This company will construct a one-story freight car repair shop and wheel shop at Brooklyn, Ore.; an addition to its steel foundry at the Sacramento, Cal., shops to cost $30,000, with a new woodworking plant and planing mill to cost $210,000 with machinery, and an acetylene generating plant to cost $50,000; and a new power plant at San Luis Obispo, Cal., to cost $50,000.

This company is constructing rock crushing plants at Santa Margarita, Cal., Palisade, Nev., and Lucin, Utah, the total cost of which will be approximately $600,000. This company is also extending its yard tracks and rearranging its man track at Nutglade, Cal., at a cost of $110,000. A line change of more than one-half mile is being made near Mott, Cal., at a cost of $135,000. Another line change costing $110,000, which involves the construction of a mile of new track is being made near Crockett, Nev.

This company has been ordered by the Louisiana Public Service Commission to construct new umbrella type train sheds with a total length of approximately 350 ft. at its passenger station at Lake Charles, La., and is preparing plans for a new passenger station at Redlands, Cal., to cost approximately $200,000.

This company is preparing plans for the construction of a second track from Tehachapi, Cal., toward Bakersfield, to cost approximately $10,000,000. The construction of 10½ miles of second track over the Tehachapi Mountains from Tehachapi to Mojave is nearly completed. The Chatsworth and San Fernando tunnels are being enlarged and lined with concrete at a cost of approximately $985,000. At Yuma, Ariz., a steel bridge with a 400-ft. span over the Colorado river is being constructed. The project at this point also includes a four-mile change in line, two miles of icing and yard tracks and a new passenger station at Yuma. The total cost of work will be approximately $1,000,000.

The Spokane, Portland & Seattle will construct a new blacksmith shop, 50 ft. by 90 ft., at Vancouver, Wash., to cost $30,000.

The Staley System's application for authority, plan to build 1,240 miles of electric railway in Arizona, New Mexico, Colorado and California has been disapproved by the Interstate Commerce Commission examiners.

The Union Pacific has awarded a contract to Peterson, Shirley & Gunther, Omaha, Neb., for the grading for 43 miles of second track between Granger, Wyo., and Leroy. This company has also awarded a contract to the Morrison-Knudson Company, Boise, Idaho, for the construction of ten miles of second track between Emory, Utah, and Echo. All track laying and the construction of bridges will be done by company forces. This company has awarded a contract to the Allied Contractors, Inc., Omaha, Neb., for skylighting the twin tunnels, each 169 ft. in length, near Edson, Wyo. This company will construct a steel and concrete viaduct 118-ft. long over its tracks near Ozone, Wyo. Another concrete and steel viaduct with embankment approaches 1,575 ft. long will be constructed at Riverdale, Utah.

This company will construct a new passenger station, 34-ft. by 190-ft., at Laramie, Wyo., to cost approximately $175,000.

This company has awarded a contract to the Campbell Construction Company, Ontario, Cal., for the construction of a reinforced concrete packing house at Ontario, Cal., to cost approximately $48,000, and has awarded a contract to McWilliams & Ross, Yakima, Wash., for the construction of a two-story brick freight shed and office building at Yakima, to cost approximately $80,000.

The Wabash has awarded a contract to Townsend B. Smith, Decatur, Ill., for the erection of an addition to its locomotive repair shop at Seventh street, St. Louis, Mo., at a cost of approximately $175,000, including equipment.

This company will construct extensions to its tracks near St. Louis, Mo., at a cost of approximately $139,000. Included in the project is a 2½-mile spur track from the main line at Granite City, Ill., to the plant of the St. Louis Coke & Chemical Company.

The Waco, Beaumont, Trinity & Sabine has applied to the Interstate Commerce Commission for authority to construct an extension from Livingston to Beaumont, Port Arthur, and West Port Arthur, Texas. The total distance is 101.1 miles, of which it is proposed to construct 80.94 miles and secure trackage rights for 20.16 miles, if possible, over the Gulf, Colorado & Santa Fe and the Beaumont, Sour Lake & Western.

The Western Fruit Express contemplates the construction of new shops at Hillyard, Wash., at a cost of approximately $200,000.

Equipment and Supplies

The Baltimore & Ohio issued an inquiry during the month for 10,000 tons of steel rails.

The Canadian National has ordered 23,000 tons of rail from the Illinois Steel Company for use on its lines in the United States.

The Chesapeake & Ohio issued an inquiry during the month for 30,000 tons of steel rails.

The Hocking Valley issued an inquiry during the month for 5,400 tons of steel rails.

The Japanese Government Railways placed orders with the Bethlehem Steel Corporation for 11,000 tons of 60-lb. and 75-lb. rails and splice bars.

The Pennsylvania Railroad has placed additional orders for 20,000 tons of steel rails to be delivered during the latter part of the current year. The orders are divided equally between the Bethlehem Steel Corporation and the Carnegie Steel Company. Orders previously placed, for delivery in 1923, amounted to 118,171 tons.

The United States Steel Corporation interests received orders recently for a total of about 200,000 tons of rail. The above includes orders for the following railroads: Chicago & Alton 8,000 tons, Pere Marquette 5,000, Union Pacific 30,000, Wabash 10,000, Norfolk & Western 20,000, Illinois Central 15,000, Central of Georgia 15,000, Louisville & Nashville 50,000, and Atlantic Coast Line 30,000.

Supply Trade News

Personal

S. Douglas Gibson, representative of Fairmont Railway Motors, Inc., Fairmont, Minn., has moved his offices, effective October 1, to Room 744, Transportation Building, Washington, D. C.

N. B. Norris has been appointed manager of the New Orleans, La., office at 938 Whitney-Central building, of the **Pawling & Harnischfeger Co.,** Milwaukee, Wis. This company has opened a new office at 1124 Book building, Detroit, Mich., with **James Van Buskirk** in charge.

C. Washburn, vice-president of the Bond County State Bank, Pocahontas, Ill., and formerly president of the Three States Tie Company, Hastings, Mich., has become associated with **W. A. Paul,** dealer in railroad ties, St. Louis, Mo., and has formed a company to be known as **Paul & Washburn,** located in the Railway Exchange building, St. Louis, Mo.

Geo. H. Chadwell, vice-president of the Anchor Company, with headquarters at St. Louis, Mo., has also taken over the Chicago territory with offices in that city succeeding **Orlando Metcalf,** who died on July 28 from pneumonia. Mr. Metcalf was western manager of the Verona Tool Works, with headquarters at Chicago from 1904 to 1910, since which he has been engaged in the rail anchor business. He organized the Anchor Company in 1922.

Exum M. Haas has resigned as manager of the railroad department of the H. K. Ferguson Company, Cleveland, Ohio, to open an office as consulting engineer at 2075 Taylor Road, Cleveland, Ohio. Mr. Haas will retain a connection with the Ferguson Company as consulting engineer on railroad projects and will specialize in railroad shop and terminal planning. He has been engaged in this phase of railway construction since 1917, having served as sales engineer for the Austin Company for three years and since August 1, 1920, as manager of the railroad department of the H. K. Ferguson Company.

General

Railway Engineering and Maintenance will move its Washington office on October 1 from 64 Home Life building to Room 815 in the new Transportation building, Seventeenth and H streets, Northwest. The Washington offices of the Association of Railway Executives, now located in the Munsey building, the American Railway Association at 718 Eighteenth street, and the Bureau of Railway Economics, now in the Homer building, are also to be brought together shortly in the new Transportation building, where the railway organizations have leased two floors.

H. D. Conkey & Company, Mendota, Ill., manufacturers of cranes and industrial cars, have appointed the **Florandin Equipment Company** as New York sales agents.

Fairbanks, Morse & Co. have purchased a tract of land formerly owned by the county workhouse at Indianapolis, Ind., and are planning to erect a new factory building adjoining the present plant, which covers 4½ acres.

The Sullivan Machinery Company, Chicago, held a picnic on August 11 at Michigan City, Ind., to commemorate the opening of its new western works at that place. Addresses were made by F. K. Copeland, president of the Sullivan Machinery Company and by the president of the Chamber of Commerce of Michigan City.

The Truscon Steel Company, Detroit, Mich., after October 1, will conduct its Michigan office in its new building at 615 Wayne street, Detroit, occupying the entire second floor. The office includes a complete service organization and engineering department. The general advertising department of the company will also be located on the same floor with the Michigan office.

The J. W. Griffin Lumber Company, Burnside, Miss., has sold to the **Reynolds-West Lumber Company,** 300,000,000 ft. of long and short leaf pine, located near Burnside. **P. J. M. Reynolds** is president of the new company and **J. M. West** is vice-president. **M. P. Barton,** until recently with the Peavy Byrnes Lumber Company, will be manager of the Burnside mill. Plans for the future contemplate the construction of a new hardwood mill to be built by the Reynolds-West Lumber Company at Burnside this year.

The Canadian Engineering & Contracting Company, Ltd., has been organized in Winnipeg, Man., to engage in general engineering and construction work, and to act as consulting, supervising and constructing engineers and in an advisory capacity to railways. **John G. Sullivan,** consulting engineer, Winnipeg, and formerly chief engineer of the Canadian Pacific, Western lines, is president, **Theodore Kipp,** president of the Kipp-Kelly, Ltd., is vice president, and **C. A. Monkman** of the Manitoba Steel & Iron Company, Ltd., is secretary of the new company.

The Continental Lumber & Tie Company has been incorporated at Peoria, Ill., with a capital stock of $1,500,000, and with sales offices at St. Louis, Mo. The company represents a combination of several concerns operating saw mills, railroads, steamboats, barge lines and the rafting of logs. The incorporators are: C. J. Case; Leonard Hillis; W. C. McClure and G. A. Case, of Peoria, Ill.; J. H. Hines, Memphis, Tenn.; Sterling Lumber Company, Bastrop, La.; J. H. Allen, St. Louis, Mo.; B. J. Altheimer, Chicago; J. H. Hines, Inc., and B. K. Boyston, Memphis, Tenn.; and Dr. J. Leland Boogher, St. Louis, Mo.

Trade Publications

Slate.—The National Slate Association, Philadelphia, Pa., has issued a booklet devoted to the adaptability of slate products for building purposes. The description includes reference to the manufacture of slate, the early uses to which it has been put, the length of service which has been rendered by the material, the various forms in which the product is obtainable under present manufacture and briefly, the manner in which it may be applied.

Trolleys—The Yale & Towne Manufacturing Company, Stamford, Conn., has published a folder describing its trolley equipment for material-handling purposes. The descriptions apply both to the plain and gear types of the new Yale steel plate roller bearing trolleys as well as to the cast iron trolleys. Reference is made to tests to which the steel plate trolley has been subjected and several illustrations are given to show the application of the trolleys for various kinds of hoisting and transferation work.

Reinforced Concrete Coaling Plants.—The Roberts & Schaefer Company, Chicago, has issued a 12-page bulletin illustrating and describing recent installations of coaling stations built by that company on various railroads throughout the country. Of special interest is a coaling station at South Junction, New York, on the Delaware & Hudson, which is equipped to mix anthracite and bituminous coal automatically in the process of elevating the coal from the track hoppers to the storage bin.

Clam Shells.—A new booklet has been issued by the Blaw-Knox Company, Pittsburgh, Pa., which is devoted to a description of this company's single line bucket, a class of equipment which uses the same line both for closing and supporting the bucket during opening. The booklet comprises 36 pages and contains a considerable amount of new clam shell data. Descriptions of the bucket are given together with tables of the dimensions and weights of the buckets and other useful data with regard to their operation, both in crane and tramway work. Many illustrations are included.

Drafting Room Standards.—The Truscon Steel Company, Detroit, Mich., has recently issued a large size, illustrated booklet on drafting room standards. This booklet includes practically all the details of design that architects and engineers must know in regard to steel window construction. Nearly all of the work is shown graphically by architectural detail sheets drawn to scale for tracing on plans. The details are shown in large size, complete in measurements and units. There is also included a folio of complete specifications covering practically every type of steel window and industrial steel door.

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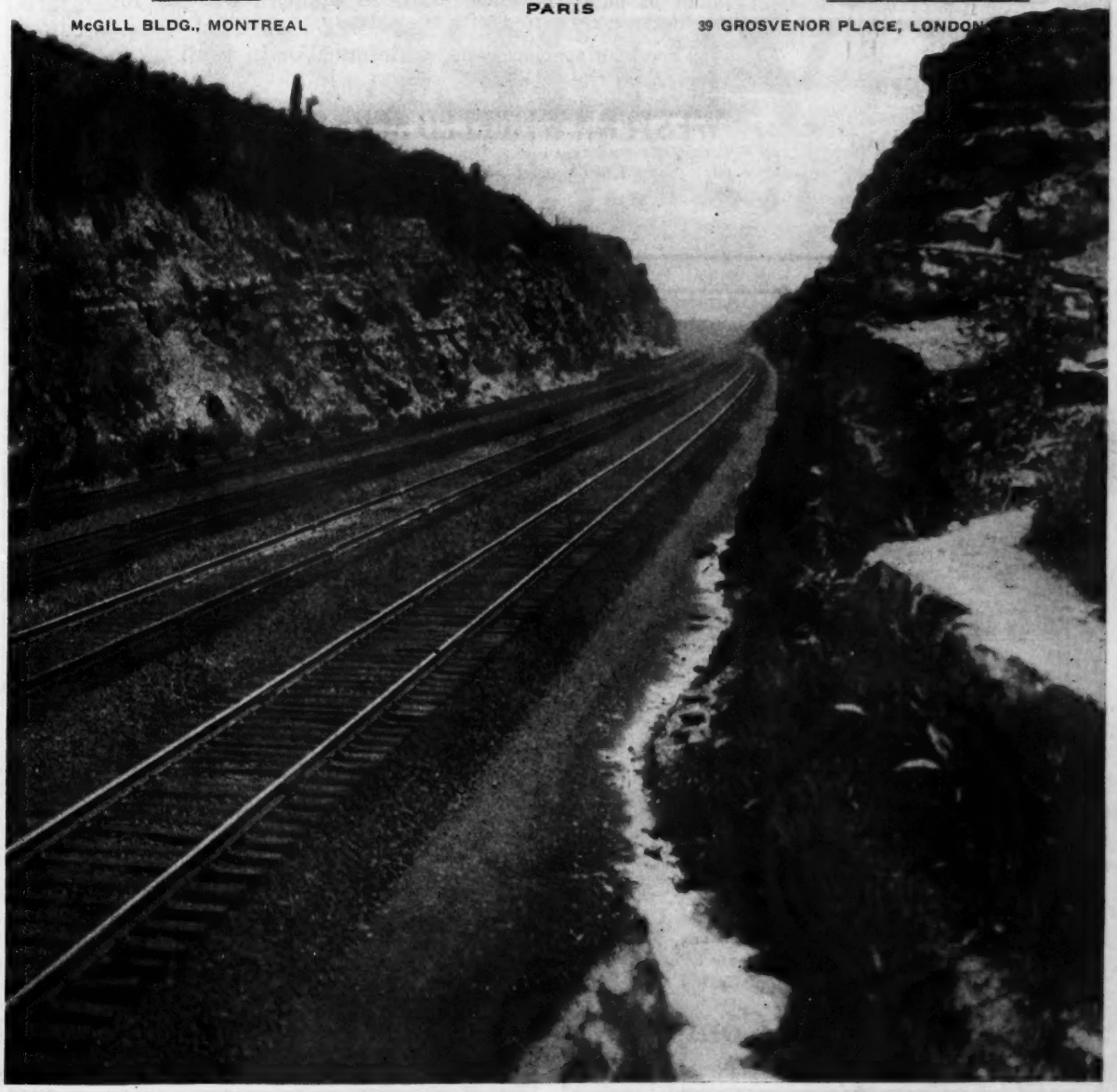
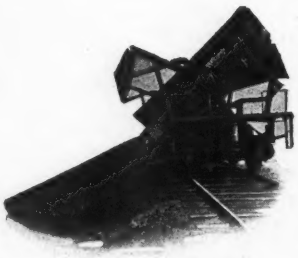


The Western Dump Car with Apron Solves Your Problem



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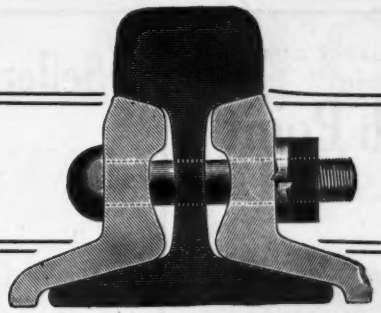
Positive  Safety

YOU are interested in lower track maintenance cost—then don't fail to reflect on the fact that here is the lock washer the use of which—due to its exclusive features including full bearing efficiency—has a direct bearing on securing just what you are interested in. The

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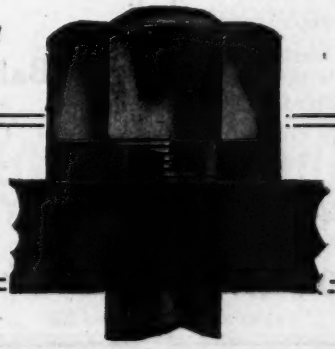
Positive  Economy

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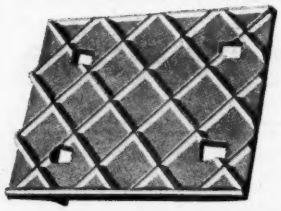

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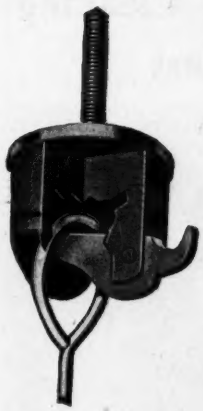

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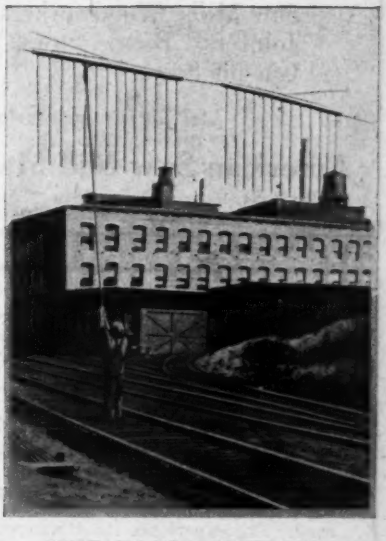

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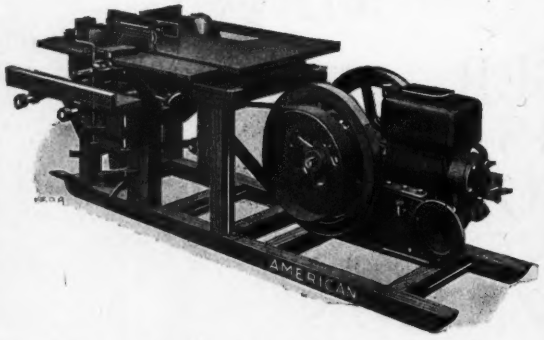

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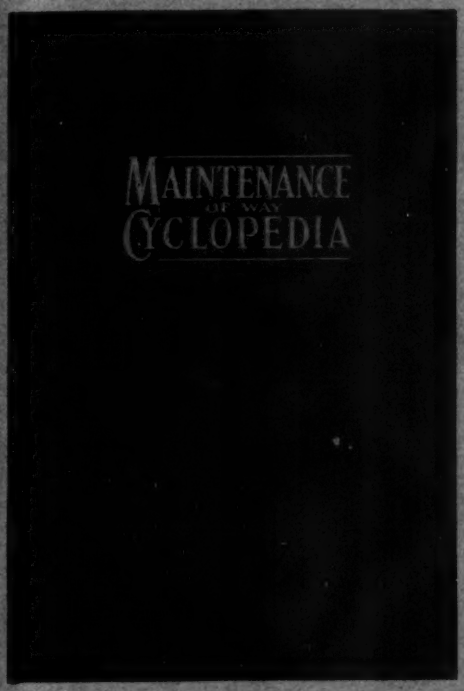

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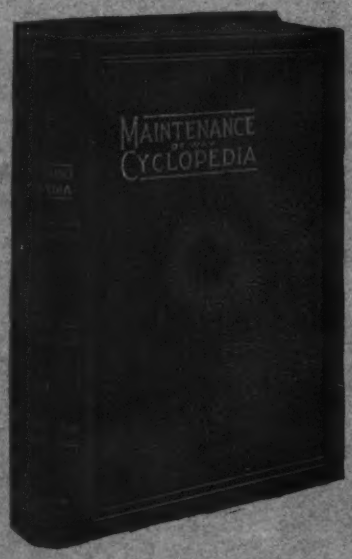

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E. R. Lewis, Formerly Chief Engineer of the Duluth, South Shore & Atlantic R. R.

K. E. Kellenberger (Signal Section), Editor of the *Railway Signal Engineer*

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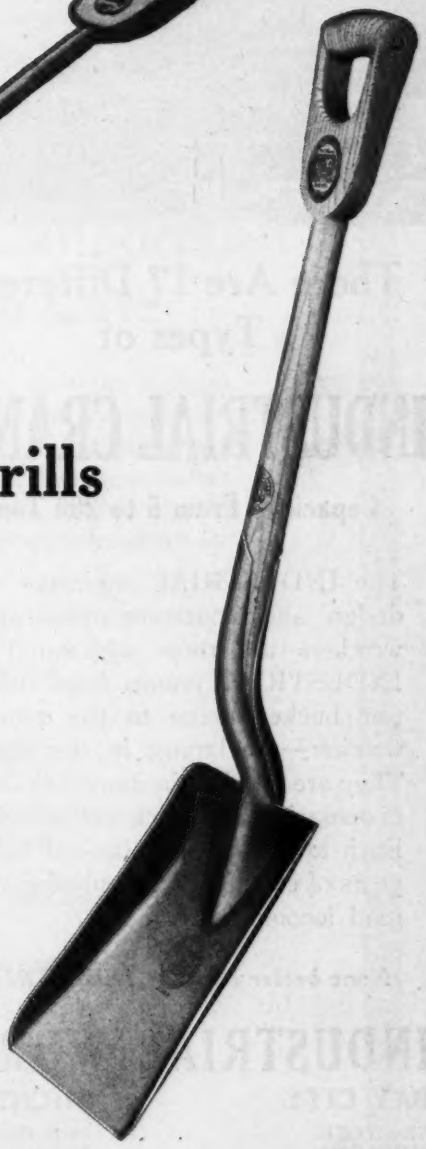

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This unusual wear has made Wood's Mo-*lyb*-den-um Steel Shovels the favorite with purchasing agents in all parts of the world. They're favorites with the men, too. For Mo-*lyb*-den-um steel blades are far lighter for a given strength. Write for complete information about the application of these super-shovels to all your needs.

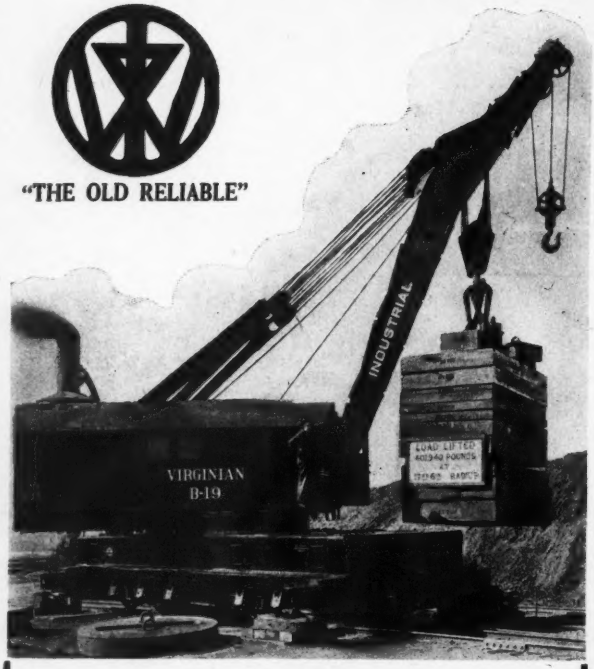
THE WOOD SHOVEL & TOOL COMPANY

Piqua, Ohio U. S. A.

Wood's Mo-lyb-den-um Shovels

The American Super Steel

"THE OLD RELIABLE"



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The INDUSTRIAL engineers who design and construct these giant wreckers are those who build all INDUSTRIAL cranes from the 5-ton bucket crane to the 200-ton wrecker—the largest in the world. They are all alike in durability, ease of operation and quickness in action. Each and every one backed by 50 years of experience in building railroad locomotive cranes.

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Full Efficiency From Your Crane With a Blaw-Knox Bucket

Built by master bucket builders who know how to fit your crane with the proper clamshell for the digging or rehandling work required.

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BLAW-KNOX BUCKETS are built to last with a minimum of expense for upkeep and repairs.

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The Blaw-Knox DREADNAUGHT

A Blaw-Knox Bucket mounted on a BUCYRUS 14-B SHOVEL

BLAW-KNOX BUCKET

PUMPS

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A TYPE FOR EVERY SERVICE

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SENECA FALLS, N. Y.

GOULDS

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BE SURE that the du Pont label is on your blasting accessories as well as on the explosives themselves—for the finest explosives made will not deliver maximum effect unless used with the best detonators and accessories. The experience of 121 years enables the du Pont Company to offer the most efficient and economical accessories for every class of explosives work.

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Tamping Bags	**Thawing Kettles**

Write for Blasting Accessories Catalog containing description of above accessories and practical information about their use.

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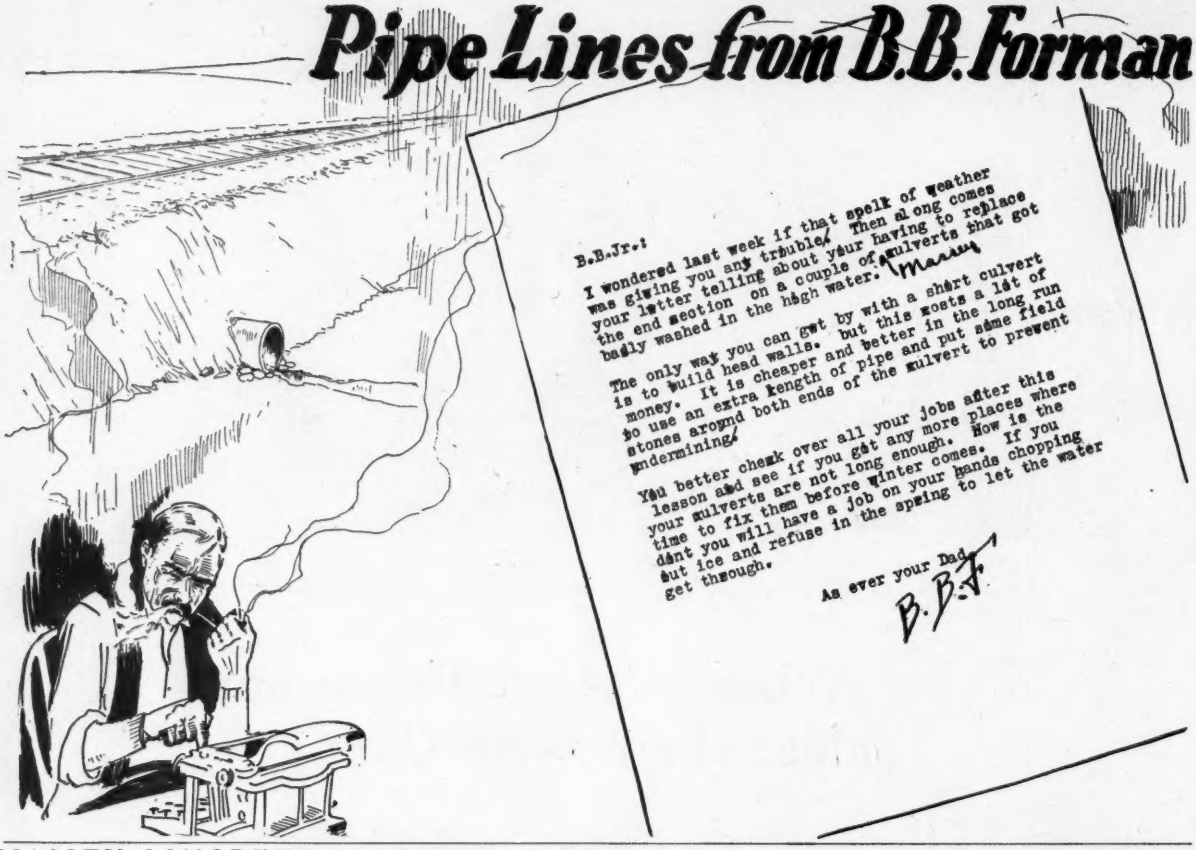
B.B.Jr.:
I wondered last week if that spell of weather was giving you any trouble. Then along comes your letter telling about your having to replace the end section on a couple of culverts that got badly washed in the high water.
The only way you can get by with a short culvert is to build head walls. but this costs a lot of money. It is cheaper and better in the long run to use an extra length of pipe and put some field stones around both ends of the culvert to prevent undermining.
You better check over all your jobs after this lesson and see if you get any more places where your culverts are not long enough. Now is the time to fix them before winter comes. If you dont you will have a job on your hands chopping out ice and refuse in the spring to let the water get through.
As ever your Dad
B.B.F.

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WATER PUMPS WATER

with a RIFE HYDRAULIC RAM without fuel, labor, freezing or repairs. A small stream operates the Rife Hydraulic Ram and fills water tanks. Easy to install. No attention required. Used by over fifty railroads, among which are:

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Manufactured in nine sizes up to and including 12 inch, the largest Ram which can be successfully used under all conditions.

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No longer do the prospector and the pack mule roam the hills in search of gold—wise men know where the gold lies and steady, concentrated effort brings it to the markets of the world.

Wise men these days are not prospecting for business and wise, buyers of railroad materials are watching the steady, consistent effort of the advertisers in

Railway Engineering and Maintenance

ARMCO
Ingot Iron

Now, after fifteen years of general use—

it is time to make some general observations.

Men who have inspected culverts—men who have actually climbed out of their cars hundreds of times and delved into the condition of highway substructures—make the following report:

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Perhaps the culverts in your district will bear out the truth of these observations. When making your inspection be sure the corrugated culverts on which you pass judgment are genuine Armco Culverts—not culverts "just as good" as Armco.

This Little Dot

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■

If this triangle were a sheet of ARMCO Ingot Iron, this little dot would represent all impurities. If it were the least bit larger by the addition of any other material, the iron could not bear the ARMCO Trade-mark. There is less than 1 part impurities to every 625 parts of pure ferrite—less than 1 *ounce* to every 39 *pounds* of pure iron.

There is a manufacturer in almost every state and in Canada, making Culverts, Flumes, Siphons, Tanks, Roofing, etc., of genuine, rust-resisting Armco Ingot Iron. Write for full information and nearest shipping point on products in which you are interested.

ARMCO CULVERT & FLUME MFRS. ASS'N
215 North Michigan Avenue, Chicago

ARMCO CULVERTS

How many of your water columns are knocked down every year?

What does the repairs and maintenance—not the result of ordinary use—cost you?

Avoid this annoyance, trouble and expense by using a

How lateral movement of spout prevents column being knocked down

POAGE Style "H" WATER COLUMN with FENNER DROP SPOUT

The three foot lateral range in the Fenner spout and the steel riser in the Poage Style H save the water column from being knocked down by the shifting of the tender.

The tender has to leave the track to knock this column down.

The flexible spout makes it unnecessary to spot the tender accurately. You save time by quick adjustment.

The five foot up and down range enables the water column to fill a tender of any height.

The open telescopic joint does not waste a drop of water. It banishes the usual winter time troubles. Ice does not collect upon it.

The valve permits the maximum amount of water to flow in the shortest time. There is a minimum of frictional resistance. It shuts the water off quick without water hammer.

Try the Poage Style H olumn. You will find that it has remarkable operating advantages.

Manufactured Exclusively By

The American Valve & Meter Co.

Cincinnati, Ohio

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"SAFETY FIRST" RAILWAY WATER SERVICE BOX

FOR

Coach Yard and Terminal

Positively Self-Closing
Either Full On or Completely Off

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Nothing to Stumble Over

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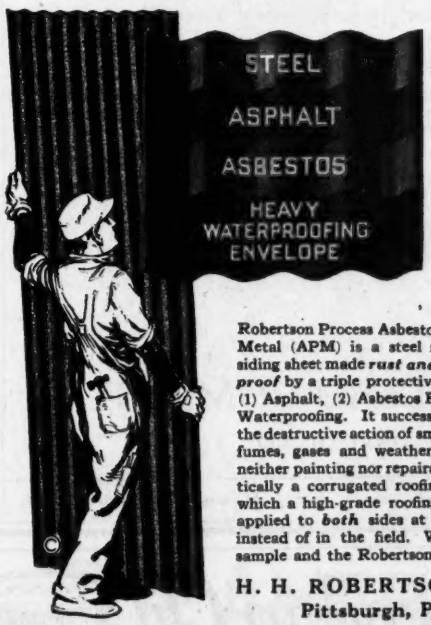
For Roofs and Siding on Railroad Buildings



Robertson Process Asbestos Protected Metal (APM) is a steel roofing and siding sheet made *rust and corrosion proof* by a triple protective coating of (1) Asphalt, (2) Asbestos Felt and (3) Waterproofing. It successfully resists the destructive action of smoke, steam, fumes, gases and weather. Requires neither painting nor repairs. It is practically a corrugated roofing sheet to which a high-grade roofing has been applied to *both* sides at the factory instead of in the field. Write for a sample and the Robertson Catalog.

H. H. ROBERTSON CO.
Pittsburgh, Pa.

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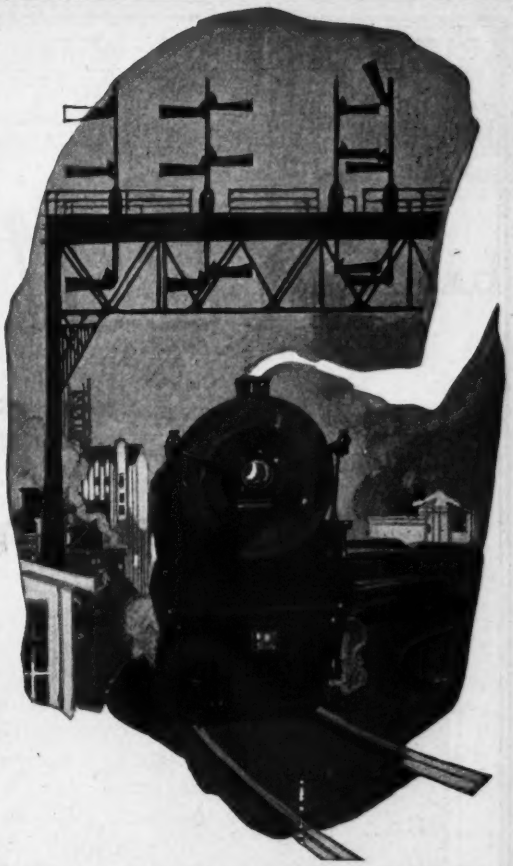

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Diamond Fibre serves faithfully because it is a tough, strong, almost indestructible insulation made by practical men to meet practical railroad conditions. "Old Timers" depend upon it because it more than meets standard specifications.

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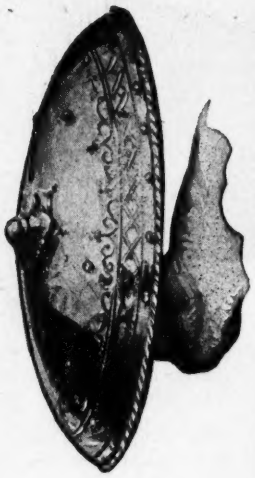
RUST-PROOFING WITH PICHER SUBLIMED BLUE LEAD

Rust



The enemy of iron and steel

NOT only the progress of man, but the retention of such achievements as he has already wrought, are accomplished only at the cost of constant battle against the forces of Nature implacably striving to break down and destroy his works.

Nowhere in the cycle of natural forces is this struggle more relentless than in the insidious RUSTING of iron and steel—the one material most essential to our twentieth century civilization.

With the national consumption of iron and steel already enormous and increasing at a continually accelerated rate, the need of universally using an efficient rust-preventive agent for the protection of iron and steel structures everywhere becomes of vital importance to every business man and to the nation.

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The superior rust-proofing efficiency of PICHER Sublimed Blue Lead in Oil was authoritatively proven by a six-year test instituted and conducted by the American Society for Testing Materials.

To the business executive, architect, engineer or property owner the use of PICHER Sublimed Blue Lead in Oil offers a unique combination of advantages in all metal-protective applications.

Write for copy of the booklet—*"Corrosion of Iron and Steel."*

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Picher Sublimed Blue Lead *in Oil*

90% of PURE blue lead ground in 10% of PURE raw linseed oil

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McWANE PRECALKED JOINT PIPE CAST IRON

Made in sizes 1¼ and 2 inches, and up to 6 inches, it is helping a dozen of America's greatest railroads today to end their troubles with rust and leakage in their small underground pipe lines. Ask for fact-booklet R.

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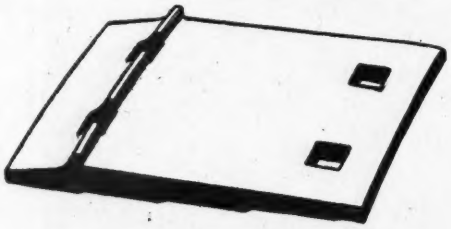

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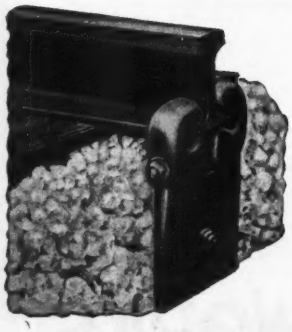
Will give rail and wheels longer life.
Will hold gauge and not injure a single fibre of the tie.
Will not rattle.



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Requires only one anchor per rail.

Will hold in both directions.

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(Trade Mark)

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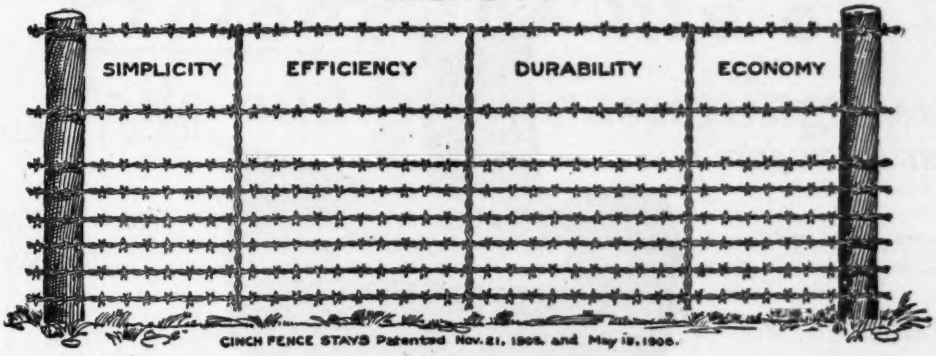
THE CINCH STAY FOR



for Your Right-of-Way Fencing Material

We furnish more Fence Stays to railroads than all other Stay Manufacturers combined.

We shall be glad to send you illustrated catalogue and quote you on your requirements. Prompt shipments guaranteed.

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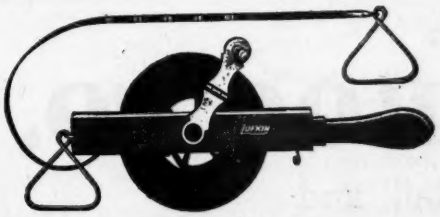
WORTH WIRE WORKS **Kokomo, Indiana**



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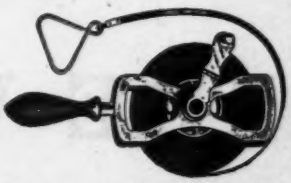

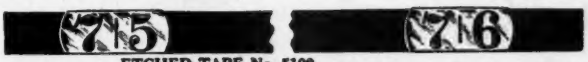

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½-gage mark when specified.

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Most popular for all rough survey and maintenance work.
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Ask your jobber to let you try one free for ten days or write us

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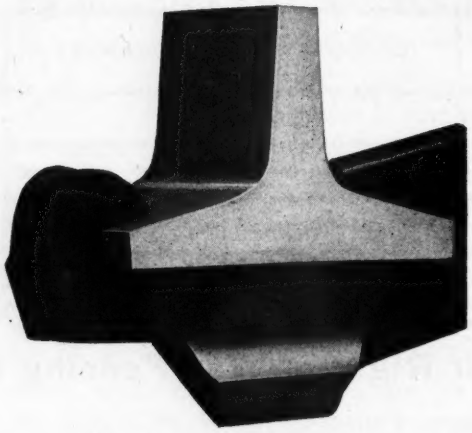
COMBINING BEST FEATURES OF SNAPLOCK AND EFFICIENCY ANCHORS.



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Track Work of Rail and Manganese Steel Construction

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FOR FROGS, SWITCHES AND CROSSINGS
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GRAY IRON CASTINGS

Prolong the life of Rails and Rail Fastenings

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The practice of spraying rails and rail fastenings to prevent corrosion has long since passed the experimental stage, and now some of the leading roads are spraying their rails twice a year, especially over that part of the line where refrigerator traffic is heavy.

Through experiments and service tests it has been demonstrated that

TEXACO No. 45 ROAD OIL

has the right adhesive quality, it contains nothing injurious to the steel and that it is the best product to use for this purpose.

No. 45 Road Oil adheres to the metal, giving maximum protection and outlasts the cheaper and unsuitable products, which must be applied oftener than No. 45 Road Oil. Therefore, the labor cost of application is less with No. 45 Road Oil.

Thirteen months after the application of No. 45 Road Oil to the rails on his road, the President of the road writes:

> **"A recent inspection of the rail which was sprayed with oil some time ago shows that the oil is still adhering to the metal in good shape and that there is a good coating of oil on the metal."**

A General Manager stated that spraying the rails on his road had prolonged their life ten years.

Why not secure the greater protection and reduced labor costs in this work by using Texaco No. 45 Road Oil.

A booklet
"Reducing Costs of Roadway Maintenance"
sent to you for the asking.

The Texas Company, U. S. A.

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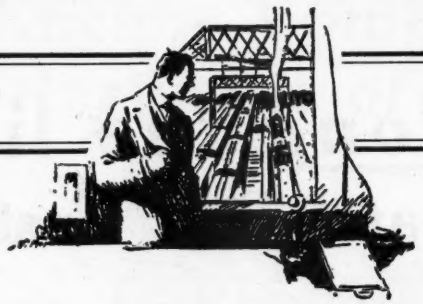
Buyers' Guide



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